

# HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

**DRAFT**

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Hatchery Program	Cowlitz River Type N Coho
Species or Hatchery Stock	Coho ( <i>Oncorhynchus kisutch</i> )
Agency/Operator	Washington Department of Fish and Wildlife
Watershed and Region	Cowlitz Subbasin/Lower Columbia Province
Date Submitted	
Date Last Updated	April 19, 2005

## Section 1: General Program Description

### 1.1 Name of hatchery or program.

Cowlitz River Coho

### 1.2 Species and population (or stock) under propagation, and ESA status.

Coho (*Oncorhynchus kisutch*) - Type N

ESA Status: Both wild and hatchery programs including the Upper and Lower Cowlitz programs are proposed for listing (NOAA 69 FR 33101; 6/14/2004).

### 1.3 Responsible organization and individuals.

Name (and title):	Mark Johnson
	Cowlitz Complex Manager
Agency or Tribe:	Washington Department of Fish & Wildlife
Address:	1182 Spencer Road, Winlock, WA 98596
Telephone:	(360) 864-6135
Fax:	(360) 864-6122
Email:	johnsmjj@dfw.wa.gov

**Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program.**

Co-operators	Role
Tacoma Public Utilities	Funding Source and Facility Maintenance
Friends of the Cowlitz	Cooperative Group that operates Coho Project (200,000 eyed eggs) in lower Cowlitz System tributaries.
Cowlitz Game and Anglers	Cooperative Group that operates Coho Project (40,000 eyed eggs) in lower Cowlitz tributaries.
Kraus Ryderwood	Cooperative Program (1,000 adipose clipped fingerlings release).
Area Schools	Salmon in the Classroom (SIC) eyed eggs.

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### 1.4 Funding source, staffing level, and annual hatchery program operational costs.

Funding Sources	
Tacoma Public Utilities	
Operational Information	Number
Full time equivalent staff	14.5
Annual operating cost (dollars)	\$1,700,000.00 (Specific costs to program cannot be broken out separately).

### 1.5 Location(s) of hatchery and associated facilities.

Broodstock source	Cowlitz Hatchery Coho Stock (Type N)
Broodstock collection location (stream, Rkm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/Rkm 78.8/Cowlitz
Adult holding location (stream, Rkm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/Rkm 78.8/Cowlitz
Spawning location (stream, Rkm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/Rkm 78.8/Cowlitz
Incubation location (facility name, stream, Rkm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/Rkm 78.8/Cowlitz
Rearing location* (facility name, stream, Rkm, subbasin)	Cowlitz Salmon Hatchery/Cowlitz River/Rkm 78.8/Cowlitz

\*Cooperative coho egg Remote Site Incubator (RSI) programs with Friends of the Cowlitz (FOC) and Cowlitz Game and Anglers incubate and release unfed coho fry in lower river tributaries. HGMPs for the cooperative projects have also been submitted (See FOC and Cowlitz Game and Anglers Coho RSI HGMPs).

### 1.6 Type of program.

Integrated Harvest Program

### 1.7 Purpose (Goal) of program.

Under the previous FERC license, the goal of this program had been to mitigate for the loss of coho that would have been produced naturally in the Cowlitz River system in the absence of the Cowlitz River Hydroelectric Project in the basin by achieving an adult goal back to the facility. Adult mitigation goals also provided significant harvest for ocean and freshwater fisheries but also by the mid-1990's started to contribute to conservation, recovery, research and education goals. Under the new license, the primary objective of the new Cowlitz River Hydroelectric Project Settlement Agreement is ecosystem integrity and the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels (FERC No. 2016, August 2004). River objectives above Mayfield Dam will be achieved through the reintroduction of Chinook, coho, steelhead and cutthroat into the upper Cowlitz River above Lake Scanewa and Tilton River (Mayfield Lake) basins. In addition, habitat improvements are planned to increase fish passage/collection facilities at key locations in the Cowlitz River Basin to increase fish survival through the Project area.

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This program will be providing adults for upriver recovery goals as outlined in the Final 2004 Cowlitz River Fisheries and Hatchery Management Plan (FHMP).

### 1.8 Justification for the program.

Coho were historically abundant in the subbasin; the Washington Department of Fisheries (1951) estimated that coho escapement was about 32,500 fish. In the Cowlitz River, an average of 24,579 coho were counted past Mayfield Dam in 1961 through 1966 (Thompson and Rothfus 1969). Estimates of coho production potential in the Cowlitz River basin above the dams range from 6,319 (Stockley 1961) to 261,254 (Easterbrooks 1980). The construction of Mayfield and Mossyrock Dams blocked access to much of the historical spawning habitat (Myers et al. 2003). The Cowlitz Salmon Hatchery was completed in 1967. The original WDFW/Tacoma Power mitigation agreement goal was 25,500 adult coho back to the Cowlitz Salmon Hatchery. Total returns back to the Cowlitz Salmon hatchery from inception to 2004 averaged 26,552 adults (approximately 104%) of the previous mitigation goal (Cowlitz Hatchery Program Annual Evaluation Reports).

By the late 1990's, most indigenous anadromous populations in the Lower Columbia ESU including the Cowlitz River system were either depressed, proposed for, candidate species or listed under the Endangered Species Act (ESA). The new Cowlitz River Hydroelectric Project Settlement Agreement (SA) has prioritized restoring ecosystem integrity with the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels (The Cowlitz River Project, FERC No. 2016, August 2004). In order to achieve these goals, the existing hatchery stocks will continue to serve as gene banks for native Cowlitz basin stocks of fish and be used to rebuild and restore wild stocks and provide continued harvest opportunities. Along with habitat and fish passage improvements, current operational and after Cowlitz Hatchery Complex remodel and phase in plans (SA Article 7), are described in detail in the Cowlitz River Fisheries and Hatchery Management Plan (SA Article 6). The Cowlitz River Fisheries and Hatchery Management Plan (FHMP) proposal will be to operate hatchery programs rearing salmonids native to the Cowlitz River as Integrated, and all non-native species as Segregated. It is unable at this point to determine the degree to which coho (or other programs) could be integrated per Hatchery Scientific Review Group (HSRG) recommendations of natural origin spawners (NOS) within the current broodstock hatchery program. In the short term, naturally produced coho will not be incorporated into the hatchery population so long as the upper basin productivity experiment is being conducted for a period of 12 – 15 years. In the short term, and all wild fish or adults produced by upper basin productivity are identified and hauled to the upper system by Tacoma Power. The Fisheries Technical Committee (FTC) will evaluate the concept of an integrated hatchery program at the Cowlitz Complex in the next iteration of the FHMP after Year 6. If natural production is high enough, at the proposed hatchery production level, 350 naturally produced coho would be needed to make up 20% of the broodstock and the ability to do this may occur sooner than 15 years. Until mass marking of coho began with 1997 brood year fish (1999 releases), an unknown level of integration occurred in the program since inception in 1967.

WDFW protects listed fish and provides harvest opportunity on the Cowlitz coho programs through the Lower Columbia Region Fish Management and Evaluation Plan (FMEP) approved by NOAA on December 31, 2003. The primary focus of anadromous salmonid fisheries in the LCR is to target harvest of known hatchery origin steelhead, spring chinook, coho salmon, sea-run cutthroat, and fall chinook. The primary focus for resident game and non-game fish in the LCR tributaries is to 1) provide recreational opportunities, 2) minimize impacts to juvenile anadromous fish through time and area closures, and 3) minimize impacts to listed species.

In order to minimize impact on listed fish by the Cowlitz River hatchery coho program and

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operations, the following Risk Aversions are included in this HGMP (**Table 1**).

**Table 1.** Summary of risk aversion measures for the Cowlitz coho program.

Potential Hazard	HGMP Reference	Risk Aversion Measures
Water Withdrawal	4.2	<ul style="list-style-type: none"><li>• Water rights are formalized from the Department of Ecology.</li><li>• Monitoring and measurement of water usage is reported (monthly NPDES reports).</li></ul>
Intake Screening	4.2	<ul style="list-style-type: none"><li>• Intake and screen criteria compliance with NOAA determined.</li><li>• Structures, updates or needed remodel or fixes assessed.</li></ul>
Effluent Discharge	4.2	<ul style="list-style-type: none"><li>• This facility operates under the “Upland Fin-Fish Hatching and Rearing” National Pollution Discharge Elimination System (NPDES) general permit</li><li>• Conducts effluent monitoring and reporting and operates within the limitations established in its permit</li><li>• Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE.</li><li>• Discharges from the cleaning treatment system are monitored</li></ul>
Broodstock Collection & Adult Passage	7.9	<ul style="list-style-type: none"><li>• Broodstock collection procedures identify listed fish.</li><li>• Safe handling protocols in place</li><li>• Listed fish placed back to stream or hauled to the upper basin</li></ul>
Disease Transmission	7.9, 10.11	<ul style="list-style-type: none"><li>• <i>Fish Health Policy in the Columbia Basin.</i></li><li>• <i>Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries</i> (Genetic Policy Chapter 5, IHOT 1995).</li></ul>

### 1.9 List of program "Performance Standards".

- See section 1.10 below.

Note: Performance Standards below only pertain to the hatchery production at Cowlitz Salmon Hatchery only and do not contain indicators for the upriver reintroduction program.

**1.10 List of program "Performance Indicators", designated by "benefits" and "risks".**

Benefits		
Performance Standard	Performance Indicator	Monitoring & Evaluation
Support Upper Cowlitz basin restoration and recovery	Provide adults if needed for additional smolt production and/or for FCE testing at CFFF	Adult cohorts monitored and tracked yearly. Fry/fingerling releases consistent with FTC and FHMP goals.
Assure that hatchery operations support Columbia River fish Mgt. Plan ( <i>US v Oregon</i> ), production and harvest objectives	Contribute to a meaningful harvest for sport, tribal and commercial fisheries. Achieve a 10-year average of 1.28 % smolt-to-adult survival that includes harvest plus escapement (18,748 fish at current production levels).	Survival and contribution to fisheries will be estimated for each brood year released. Work with co-managers to manage adult fish returning in excess of broodstock need.
Maintain outreach to enhance public understanding, participation and support of Washington Department of Fish & Wildlife (WDFW) hatchery programs	Provide information about agency programs to internal and external audiences. For example, local schools and special interest groups tour the facility to better understand hatchery operations. Off station efforts may include festivals, classroom participation, stream adoptions and fairs.	Evaluate use and/or exposure of program materials and exhibits as they help support goals of the information and education program.  Record on-station organized education and outreach events.
Program contributes to fulfilling tribal trust responsibility mandates and treaty rights	Follow pertinent laws, agreements, policies and executive and judicial orders on consultation and coordination with Native American tribal governments	Participate in annual coordination meetings between the co-managers to identify and report on issues of interest, coordinate management, and review programs (FBD process).
Implement measures for broodstock management to maintain integrity and genetic diversity	A minimum of 3000 adults are collected throughout the spawning run in proportion to timing, age and sex composition of return. Maintain effective population size.	Annual run timing, age and sex composition and return timing data are collected. Adhere to WDFW spawning guidelines. (WDFW 1983)
Region-wide, groups are marked in a manner consistent with information needs and protocols to estimate impacts to natural and hatchery origin fish	Use mass-mark (adipose-fin clip) for selective fisheries with additional groups Ad+CWT, RV or LV for evaluation purposes	Returning fish are sampled throughout their return for length, sex, mark and origin.
Maximize survival at all life stages using disease control and disease prevention techniques. Prevent introduction, spread or amplification of fish pathogens. Follow Co-managers Fish Health Disease Policy (1998).	Necropsies of fish to assess health, nutritional status, and culture conditions	WDFW Fish Health Section inspect adult broodstock yearly and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, WDFW's Fish Health Section recommends remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary  A fish health database will be maintained to identify trends in fish health and disease and implement fish health management plans based on findings.
	Release and/or transfer exams	1 to 6 weeks prior to transfer or release, fish are examined in accordance with the Co-managers Fish Health Policy
	Inspection of adult broodstock	At spawning, lots of 60 adult broodstock are examined for pathogens
	Inspection of off-station fish/eggs prior to transfer to hatchery	Control of specific fish pathogens through eggs/fish movements are conducted in accordance to Co-managers Fish Health Disease Policy.

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### 1.10.1 Risks:

Risks		
Performance Standard	Performance Indicator	Monitoring & Evaluation
Minimize impacts and/or interactions to ESA listed fish	Hatchery operations comply with all state and federal regulations. Hatchery juveniles are raised to smolt-size (15 fish/lb) and released from the hatchery at a time that fosters rapid migration downstream. Mass mark production fish to identify them from naturally produced fish (except CWT only groups)	As identified in the HGMP: Monitor size, number, date of release and mass mark quality. Additional WDFW projects: straying, instream evaluations of juvenile and adult behaviors, NOR/HOR ratio on the spawning grounds, fish health documented.
Artificial production facilities are operated in compliance with all applicable fish health guidelines, facility operation standards and protocols including HOPPS, Co-managers Fish Health Policy and drug usage mandates from the Federal Food and Drug Administration	Hatchery goal is to prevent the introduction, amplification or spread of fish pathogens that might negatively affect the health of both hatchery and naturally reproducing stocks and to produce healthy smolts that will contribute to the goals of this facility.	Pathologists from WDFW's Fish Health Section monitor program monthly. Exams performed at each life stage may include tests for virus, bacteria, parasites and/or pathological changes, as needed
Ensure hatchery operations comply with state and federal water quality and quantity standards through proper environmental monitoring	NPDES permit compliance  WDFW water right permit compliance	Flow and discharge reported in monthly NPDES reports.
Water withdrawals and instream water diversion structures for hatchery facility will not affect spawning behavior of natural populations or impact juveniles.	Hatchery intake structures meet state and federal guidelines where located in fish bearing streams.	All fish entering the hatchery are documented: Hatchery records. Visual observations recorded. Barrier and intake structure compliance assessed and needed fixes are prioritized.
Hatchery operations comply with ESA responsibilities	WDFW completes an HGMP and is issued a federal and state permit when applicable.	Identified in HGMP and Biological Opinion for hatchery operations.
Harvest of hatchery-produced fish minimizes impact to wild populations	Harvest is regulated to meet appropriate biological assessment criteria. Mass mark juvenile hatchery fish prior to release to enable state agencies to implement selective fisheries.	Harvests are monitored by agencies and tribes to provide up to date information.

### 1.11.1 Proposed annual broodstock collection level (maximum number of adult fish).

At the current program size, the number of broodstock collected is up to a total of 3,000 adults at a female (1,500) to male (1,500) ratio of 1:1. Up to 2% of the male component is made up of jacks (approximately 75).

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### 1.11.2 Proposed annual fish release levels (maximum number) by life stage and location.

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (RKm)	Major Water-shed	Eco-province
Yearling	3,200,000	15.0	May	Cowlitz River	78.8	Cowlitz	Lower Columbia

1. In 2002, the coho yearling program was reduced to 3,200,000 fish at 15 ffp or 213,333 lbs.
2. Additionally, 40,000 eyed eggs are transferred to the Cowitz Game and Anglers for Remote Site Incubation (RSI) programs on several tributaries in the lower Cowlitz River and one site on the Coweeman River. Eggs are incubated for 2-3 months and unfed fry are released into the tributaries. A separate HGMP will be submitted for this group.
3. Additionally, 200,000 eyed eggs are transferred to the Friends of the Cowlitz for Remote Site Incubation (RSI) programs on several tributaries in the lower Cowlitz River. Eggs are incubated for 2-3 months and unfed fry are released into the tributaries. A separate HGMP will be submitted for this group.
4. Additionally, 1,000 fingerling coho at 100 ffp are transferred to the Kraus Project for planting in Cambell Creek.
5. 1,700 eggs total are transferred to numerous school aquarium projects.

### 1.12 Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Along with harvest contribution in ocean and river fisheries, the original WDFW/TPU mitigation agreement goal was 22,253 adult coho back to the Cowlitz Salmon Hatchery. Total escapement levels from inception to 2004 have averaged 26,552 adults (approximately 120%) of mitigation goal (Cowlitz River Annual Reports). Starting in 1996, available coho adults above broodstock needs were reintroduced into the upper Cowlitz basin. Under the draft FHMP, no restrictions on placing hatchery fish upstream will occur until a trigger of 40% fish passage survival is achieved with current survival under 20%.

**Smolt-to-adult survival rates** –Overall survival averaged 1.28 % from brood years 1988-1998. Survival during brood years 1990 –1994 years were low (range of 0.17% – 0.50%) respectively while significantly higher survival rates have occurred from brood year 1998 to the present based on escapement.

**Adult production levels** – For the period of the last 15 years, total catch has fluctuated significantly from lower levels (return years 1994 – 1998) of approximately 5,000 fish to a high catch of 138,388 in 1991. The average during this time through 2001 is 31,168 fish.

**Escapement levels** - From 1967 through 2004, more than a million coho (1,008,983) have returned to the Cowlitz Salmon Hatchery. Total escapement levels (not counting wild coho) from 1967 to 2004 have averaged 26,552 adults (approximately 104%) of the previous mitigation goal (25,500). Since 2000, hatchery escapement levels have been significantly higher, and averaged 54,665 which is more than 200% of mitigation goal (**Table 2**). Beginning with brood 1997. coho releases were mass marked which enabled staff to distinguish hatchery and wild fish



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beginning with returns in 1999. Additionally, since 1999, significant levels of hatchery coho along with all wild coho have been transported for upper Cowlitz basin reintroduction efforts (Section 2.2.3).

**Table 2. Cowlitz Salmon Hatchery Coho Adult Returns**

Year	# Adults	BRD YR SAR	Year	# Adults	BRD YR SAR
1980	28,776		1993	5,641	0.41
1981	27,003	NA	1994	6,922	0.24
1982	22,528	NA	1995	7,502	0.44
1983	24,493	NA	1996	11,352	NA
1984	26,149	NA	1997	15,570	NA
1985	18,610	NA	1998	18,378	1.25
1986	54,685	NA	1999	34,200	2.8
1987	18,716	NA	2000	48,978	NA
1988	30,888	4.59	2001	73,215	NA
1989	35,886	1.18	2002	75,574	NA
1990	13,009	0.50	2003	31,072	NA
1991	46,303	0.17	2004	44,485	NA
1992	14,780	0.24	2005	-	

**Sources** - Stock assessment reports (BPA), WDFW annual reports, StreamNet Annual Coded-Wire Tag Program, Washington Missing Production Groups, Cowlitz Annual Reports (1994-2000).

### 1.13 Date program started (years in operation), or is expected to start.

This program has been in operation since construction of the hatchery in 1967.

### 1.14 Expected duration of program.

Coho production from CSH is part of the continued operation of the Cowlitz River Hydroelectric Project, FERC Project No. 2016, operated under the new license with an effective date of July 18, 2003. The license is for a term of 35 years and expires July 18, 2038.

### 1.15 Watersheds targeted by program.

- Cowlitz Subbasin/Lower Columbia Province

### 1.16 Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

#### 1.16.1) Brief Overview of Key Issues

Note: Issues stated below have been addressed in the new FERC Settlement Agreement (The Cowlitz River Project, FERC No. 2016, August 2004).

Issue 1: Since 1967, coho have been released to the Cowlitz River in order to satisfy the mitigation adult goal and also contributed significant harvest benefits to freshwater and limited ocean fisheries. Ocean survival through the 1990's dramatically affected contribution and survival. With increased survival in the late 1990's, coho juvenile and adults were used for upriver reintroduction. The new SA has been agreed upon by the parties to prioritize the continued operation of the hatcheries for the restoration and recovery of wild, indigenous salmonid runs, including ESA-listed and unlisted stocks, to harvestable levels. In the recent FHMP, reductions of hatchery production have been proposed but should be based on whether fish passage (Issue 2) is successful and whether upper basin productivity has been proven.

Issue 2: In the new SA, significant upper river reintroduction and natural production is occurring. Since the mid-1990's, significant restoration activities in the upper basin have taken place including adult re-introduction, fry and fingerling releases and subsequent natural smolt productivity. The greatest obstacle to restoration of upper basin anadromous fish runs is downstream passage of juvenile salmonids (smolts). They must be captured or collected to ensure that they do not residualize in a reservoir or run through a turbine. The Cowlitz Falls Dam (operated by the Lewis County Public Utility District) is the center of efforts to collect downstream migrant salmonids and transport them safely around hazards of reservoirs and dams to the lower river. Juvenile salmonids produced in the Tilton River pass downstream through a fishway at Mayfield Dam.

### **1.16.2) Potential Alternatives to the Current Program**

Note: Although instructions in the Potential Alternatives HGMP section indicate draft plans not necessarily endorsed by management, the following alternatives have been agreed upon and supported by parties to the SA.

Alternative 1: Significant remodel plans within the Cowlitz Complex facilities are described in Article 7 that will be of significant benefit to producing coho for continued support of upper river efforts. Both the Cowlitz Salmon Hatchery and Cowlitz Trout Hatchery will be rebuilt within five years of license issuance with emphasis on innovative rearing practices. Planning, developing and reviewing alternatives for Cowlitz River Fisheries Management is currently underway through the Cowlitz Fisheries Technical Committee. The committee is comprised of representatives from Washington Department of Fish and Wildlife, NOAA fisheries, Tacoma Power, Trout Unlimited, Washington Department of Ecology, US Fish and Wildlife Service, and The Yakima Indian Nation. These include: a) hatchery design drawings that include decreased rearing densities and innovative practices to replicate historic out-migration size and timing; b) plans for construction scheduling; c) provision for hatchery water supply that maximizes water from existing groundwater wells and, if necessary, provides for treatment of up to 10 cfs additional river water; and d) a plan for gradual transition to innovative rearing practices. Both, current and future lower and upper river production are proposed by the FHMP. The FHMP indicates that as natural production increases, hatchery production would decrease based on credit mechanisms (see section 3.7 FHMP) after the hatchery re-build (>2008). The Project though has inundated miles of river and tributaries that natural production may not totally be able return to pre-project levels. WDFW is committed to improving hatchery production and making it consistent with wild fish restoration in the Cowlitz basin, but modification of hatchery practices or reductions in lower river production must be evaluated.

Alternative 2: Significant habitat improvements for upstream and downstream have been agreed to in the SA including: Article 1. Downstream Fish Passage: Riffe Lake and Cowlitz Falls Collection and Passage, Article 2. Downstream Fish Passage: Mayfield and Article 3. Upstream Fish Passage: Barrier, Mayfield and Mossyrock. In the meantime, existing hauling of adults and trucking of smolts will continue. A number of issues hinge on the success of fish passage improvements including the full potential of the upper basin production.

### **Potential Reforms and Investments:**

Although costly, the development of restoration programs for the Cowlitz River watershed upstream of the barrier Dam represents a balancing act between competing needs for harvest and stock restoration, the evolving improvement of fish collection and passage for downstream migrants, the restoration of ecological function in the watershed, and host of other inputs currently unknown. The plan used to guide the process will need to be flexible enough to adapt to new information, aggressive enough to achieve success, and well-enough evaluated to guide this and future projects of this type.

## Section 2: Program Effects on ESA-Listed Salmonid Populations

### 2.1 List all ESA permits or authorizations in hand for the hatchery program.

None, although NOAA Fisheries has consulted on the operations of all the fish production activities at these facilities as part of a Columbia River basin wide hatchery biological opinion in 1999 for listings prior to 1998. On March 23, 2004, NOAA Fisheries (Consultation No. 2001/02045) issued a Biological Opinion for the Cowlitz River Hydroelectric Project (FERC No. 2016).

### 2.2 Descriptions, status and projected take actions and levels for ESA-listed natural populations in the target area.

The following ESA listed natural salmonid populations occur in the subbasin where the program fish are released:

ESA listed stock	Viability	Habitat
Spring Chinook	M	L
Cowlitz Fall Chinook	L	L
Coweeman Fall Chinook-Natural	H	M
Toutle Fall Chinook	M	L
Late Winter Steelhead	H	L
Coho- (Proposed)	Na	Na
Chum	Na	Na
H, M and L refer to high, medium and low ratings, low implying critical and high healthy.		

#### 2.2.1 Description of ESA-listed salmonid population(s) affected by the program.

**Identify the ESA-listed population(s) that will be directly affected by the program.**

**Lower Columbia River spring chinook salmon** listed as “threatened” under the ESA on May 24, 1999. Of the 14 hatchery stocks included in the LCR ESU, only the Cowlitz River spring chinook salmon was considered essential for recovery, but was not listed (64 FR 14308, March 24, 1999).

**Identify the ESA-listed population(s) that may be incidentally affected by the program.**

**Lower Columbia River fall chinook salmon** are listed as “threatened” under the ESA on May 24, 1999.

**Lower Columbia River Steelhead** listed as threatened under the ESA on March 19, 1998.

**Lower Columbia River Coho** within the Lower Columbia River/Southwest Washington Evolutionary Significant Unit (ESU) were proposed as threatened under the federal Endangered Species Act in 2004 (NOAA 69 FR 33101; 6/14/2004).

**Columbia River Chum salmon (*Oncorhynchus keta*)** listed as “threatened” under the ESA on March 25, 1999

### 2.2.2 Status of ESA-listed salmonid population(s) affected by the program.

Describe the status of the listed natural population (s) relative to “critical” and “viable” population thresholds. Current and future recovery goals and population targets have been established for Chinook, coho, chum and steelhead populations in the LCR ESU by the Lower Columbia Fish Recovery Board (LCFRB Basin Plans 2004). The Settlement Agreement states that it is the responsibility of NOAA-Fisheries and USFWS to set the adult abundance values used to determine the sustainability of spring Chinook and late winter steelhead in the upper Cowlitz River and for all anadromous fish species in the Tilton River. These abundance values are used as one of the two criteria for determining when upstream adult fish passage facilities would be constructed at the Project. Interim minimum abundance targets for the Tilton River and upper Cowlitz River populations have been outlined in Section 3.5.1 of the Cowlitz River FHMP. . It should be emphasized that these proposed abundance targets are based on the interpretation of currently available data and literature and should be modified as more rigorous analysis of new data is completed (FHMP). With an increase habitat improvements, increased future recovery goals and potential population targets will be established in future FHMPs.

**Lower Columbia River spring chinook salmon (*Oncorhynchus tshawytscha*):** The hatchery program will be providing HOS for the upper river program until natural productivity and fish passage improvements are established (**Table 3**). In the lower river, escapement levels (which include hatchery-origin fish) are typically only 200 to 400 fish with an average of 273 since 1980 (**SaSI** 2002). In 2003 (1,937) and 2004 (1,793) reflected an increase (**Table 4**). Significant numbers of adults have been re-introduced to the upper Cowlitz the past two years although most have been hatchery adults with 4.1% made up of wild spawners. Wild smolts made up 18,383 (43.7%) of the smolts collected at CFFF (**Appendix A**). Total smolts collected was 42,781 with a fish collection efficiency of 19% yielding a total of 96,753 wild smolts and 128,411 fish from fry plants (RV marked) with the approximately 225,000 smolts produced in 2004 representing an increase over past levels of approximately 111,000 from 1997-2002 (**Table 5**). The current carrying capacities of the Upper Cowlitz basin is 311,000 spring Chinook smolts (Serla and Morrill). Currently, the Fish Collection Efficiency (FCE) at CFFF can capture approximately 19% of the smolt production. Future improvements to the facility could increase the FCE to 75%-95%.

**Table 3.** Spring Chinook Adults transported to the Upper Cowlitz River Basin, 1996 – present.

Year	Not sexed	Female Ad Clip	Female Un Mark	Male Ad Clip	Male Un Mark	Jack	Total
2004		4,786	116	5,928	139	502	11,471
2003		4,482	264	4,089	284	18	8,589
2002	1,465	119	Unk	179	Unk	50	1,787
2001		68	Unk	60	Unk	0	128
2000		98	Unk	106	Unk	0	204
1999		53	Unk	38	Unk	177	268
1998		0	0	0	0	0	0
1997		0	0	25	0	26	51
1996		2	Unk	4	Unk	0	6

Source – Cowlitz Falls Annual Reports 1997-2004.

**Table 4. Spring Chinook Abundance Estimates in the Lower Cowlitz River**

Year	Lower Cowlitz River
1990	320
1991	284
1992	279
1993	236
1994	167
1995	347
1996	36
1997	455
1998	356
1999	285
2000	266
2001	347
2002	419
2003	1,937
2004	1,793

Source – Lower Columbia Region FMEP 2003 and WDFW Spawning Surveys (2004).

**Table 5. Total smolt production\* of the Upper Cowlitz since 1997.**

Year	Steelhead Unmarked	Steelhead RV(& hatchery)	Coho	Chinook	Cutthroat	Total Emigration
2004	23,249	44,355	308,079	225,164	1,487	602,334
2003	21,565	25,480	400,762	254,368	1,880	704,055
2002	9,300	41,361	168,281	119,673	1,676	340,291
2001	30,861	66,629	796,948	156,545	1,867	1,052,850
2000	26,184	25,426	236,960	136,920	2,051	427,541
1999	25,368	28,235	88,788	36,717	1,349	180,457
1998	24,505	39,321	196,520	51,913	1,363	313,622
1997	7,714	29,253	17,490	134,206	722	189,385

Source – Serl and Morrill (Annual Cowlitz Falls Report – 2004 DRAFT)

**Lower Columbia River fall chinook salmon (*Oncorhynchus tshawytscha*): Cowlitz River:** Forty-six percent of the fall chinook run in the Cowlitz River was estimated to have come from above Mayfield Dam in 1950 to 1961, and 28 percent of the spawning grounds were inundated by Mayfield and Mossyrock reservoirs (Easterbrooks 1980). Age ranges from 2-year-old jacks to 6-year-old adults, with dominant adult age of 3, 4, and 5 (averages are 16.49%, 58.05%, and 19.31%, respectively). Natural spawning abundance is more a reflection of the size of returns to the Cowlitz Salmon Hatchery and stray rates than of natural production. The natural spawning escapement goal is 3,000 adults. Until 2001 the goal had not been met since 1989 (SaSI 2002). In 2002, escapement was 1,427 while 2003 had 10,329 and 4,466 were reported for 2004 (**Table 6**). Most of the spawning takes place between the Kelso Bridge and the Cowlitz Salmon Hatchery

## Cowlitz River Coho

(WDF et. al. 1993). Fall Chinook will not be used in the upper Cowlitz while the spring Chinook evaluation is ongoing but adults are taken to the Tilton River. Currently, fall Chinook are taken to the Tilton River system but not the upper Cowlitz River (**Table 7**). Smolt production is collected at Mayfield Dam (**Table 8**).

**Coweeman River:** Historically, Coweeman River fall chinook spawned from Mulholland Creek (RM 18.4) downstream approximately 6 miles to the Jeep Club Bridge (WDF et. al. 1993). The estimated annual escapement of fall chinook in 1951 was 5,000, although splash dams probably impacted production (WDW 1990). The Coweeman River has received fall chinook plants from at least 1951 until 1979 (WDW 1990). SaSI (WDF et. al. 1993) listed fall chinook stocks as healthy in 1993; status today is depressed (SaSI 2002).

**Toutle River Fall Chinook.** Natural spawners of both hatchery and natural origin in the Toutle subbasin averaged 6,573 fish from 1964 through 1979 with the following distribution: 4.8 percent from the mainstem, 3.8 percent South Fork Toutle, 49.4 percent North Fork Toutle, and 42 percent Green River (Kreitman 1981 as cited in WDW 1990). Natural spawners (hatchery and natural origin) from 1964 through 1979 averaged 42 percent (equal to 4,517 fish) of the Toutle subbasin spawners, which were estimated at 10,756 fish (Kreitman 1981 as cited in WDW 1990). From 1990–2001, escapement in the South Fork Toutle system averaged 57 fish although significant increases in fall Chinook escapement for 2002 and 2003 reflect the Lower Columbia River trend for those past 2 years.

**Table 6.** Fall chinook salmon abundance estimates in the Cowlitz System

Year	Coweeman River	Cowlitz River	Green River	SF Toutle River
1990	241	2,698	123	0
1991	174	2,567	123	33
1992	424	2,489	150	0
1993	327	2,218	281	3
1994	525	2,512	516	0
1995	774	2,231	375	30
1996	2,148	1,602	667	351
1997	1,328	2,710	560	0
1998	144	2,108	1,287	66
1999	93	997	678	42
2000	126	2,700	852	27
2001	646	5,013	4,951	132
2002	891	14,427	7,452	444
2003	1,082	10,329	13,806	137
2004	1,550	4,466	4,108	603

Source – LCR FMEP (2003) up to 2001. 2002 – 2004 data from WDFW database.

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**Table 7.** Annual numbers of adult fall Chinook (FCK), coho salmon, winter steelhead (WSH), Late Winter Steelhead (LWS), and sea-run cutthroat trout adults transported into the Tilton River system from Cowlitz Salmon Hatchery (CSH) by origin, species, and sex.

Year	Hatchery						Wild				
	Species	Females	Males	Jacks	Non sexed	Total Hatchery	Females	Males	Jacks	Non sexed	Total Wild
1997	FCK	3	24	84		111					0*
	Coho	867	2,766	2,056		5,689					
	WSH	293	289		286	868	8	11			19
	SRCT									79	79
1998	FCK	2	98	141		241					0*
	Coho	903	1,106	1944		3,953	535	647	460		1,642
	WSH	92	158	83		333					
	SRCT										
1999	FCK		1	72		73					
	Coho	2,469	3,058	2,471		7,998	573	673	29		1,275
	WSH				339	339		104			104
	SRCT							62			62
2000	FCK		1	636		637					0*
	Coho	4,933	6,138	4,006		15,077	159	252	85		496
	WSH	324	323		7	654	72	47			119
	LWSH						2	6			8
	SRCT										
2001	FCK	588	1582	1,065		3,235					0*
	Coho	12,569	14,770	1,808		29,147	660	1063	156		1,879
	WSH	214	320	8		542	88	84			172
	LWSH						1				1
	SRCT									92	92
2002	FCK	1,774	3,765	16		5,555					0*
	Coho*	6,165	7,989	1,673		15,827	525	661	69		1,255
	WSH	477	601	3	451	1,532	152	153	1	300	606
	LWSH									12	12
	SRCT									7	7
2003**	FCK	1,968	2,317			4,285					0*
	Coho	3,465	3,341			6,806					617
	WSH					0					84
	LWSH					377					74
	SRCT					0					617
2004**	FCK	945	1,269			2,214					0*
	Coho					12,030					381
	WSH					0					319
	LWSH					503					26
	SRCT										69

\*Coho adult numbers for return-year 2002 are incomplete; totals are through Dec. of 2002.

0\* Fall Chinook wild/hatchery cannot be determined without mass mark to this point.

\*\* Data for 2003 and 2004 male/female breakdowns are not available.

Source – Cowlitz Hatchery annual reports and D. Harmon (2002-2003).

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**Table 8.** Mayfield Dam downstream fish passage. Migrants captured with estimated FGE (fish guidance efficiency) and turbine survival applied to estimate passage survival (PS) and total passage.  $PS\% = (FGE \times \text{bypass survival}) + ((1 - FGE) \times \text{turbine survival})$ . Fish Guidance Efficiency (FGE) at the collection site: 66.4% for coho, 81.4% for Chinook and 73.6% for Steelhead.

Year	Coho Salmon				Chinook Salmon				Steelhead			
	Captured	Est. Total Run	PS %	Est. Total Passage	Captured	Est. Total Run	PS %	Est. Total Passage	Captured	Est. Total Run	PS %	Est. Total Passage
1995	374	563	95.3	537	317	389	96.5	376	2560	3478	95.9	3335
1996	1773	2670	95.3	2545	64	79	96.5	76	3318	4508	95.9	4323
1997	895	1348	95.3	1285	4456	5474	96.5	5283	329	447	95.9	429
1998	16747	25221	95.3	24039	2153	2645	96.5	2553	6476	8799	95.9	8437
1999	8006	12057	95.3	11492	86	106	96.5	102	2893	3931	95.9	3769
2000	23535	35444	95.3	33783	62	76	96.5	74	3528	4793	95.9	4596
2001	82215	123818	95.3	118013	618	759	96.5	733	7447	10118	95.9	9702
2002	11675	17583	95.3	16759	19282	23688	96.5	22862	2050	2785	95.9	2671
2003	38892	58572	95.3	55826	10825	13299	96.5	12835	4790	6508	95.9	6241
Mean	20457	28732	95.3	27385	4207	1361	96.5	1314	3710	5154	95.9	4942
*Assumes 90% turbine survival, 98% bypass survival, no spillway passage												

Source. NOAA Fisheries consultation No. 2001/02045- Biological Opinion for ESA Section 7 Consultation for the Cowlitz River Hydroelectric Project (FERC No.2016).

**Lower Columbia River Steelhead (*Oncorhynchus mykiss*):** In Washington, the LCR steelhead ESU includes winter and summer steelhead in tributaries to the Columbia River between the Cowlitz River and Wind River. The Cowlitz system had six historical populations including three core (Cispus, Upper Cowlitz and N.F. Toutle) populations. All are winter steelhead stocks with the Cispus winter run population hatchery stock is listed as a core genetic legacy population (Myers et al. 2002). Late winter steelhead including wild adults of wild and fry plants (RV) and of lower river hatchery releases have been transferred upstream since 1996 (**Table 9**). In 2004, 35,032 steelhead smolts were collected at the CFFF of which 11,276 (32%) were of wild origin (**Appendix A**). Fry plants identified by RV clip contribute to the escapement, while yearling plants of RV and adipose fin clips (37,500) provide some level of harvest on identified steelhead for the upper basin. As FCE was 48.5% for steelhead, current production in the upper basin is approximately 65% of the 1994 GAIA estimates (100,000) carrying capacity of the upper Cowlitz River. Steelhead abundance estimates are made in a number of Lower Columbia tributaries including the S.F Toutle, Green, Coweeman, E.F Lewis and Washougal Rivers but not the Lower Cowlitz system (FMEP 2003).



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**Table 9.** Late Winter Steelhead Adults transported to the Upper Cowlitz River Basin, 1996 - present.

Year	UM – Unmarked STHD			RV – Right Ventral Clip			AD – Adipose Clip			Totals
	UM- Female	UM- Male	UM- Jack	RV - Female	RV - Male	RV – Jack	AD- Male	AD – Female	AD - Jack	
1996-7	22	12	0	5	14	0	0	1	0	54
1997-8	6	5	0	5	1	0	26	23	0	66
1998-9	15	24	13	10	29	3	6	49	8	157
1999-2000	108	107	0	28	73	0	19	77	0	412
2000-01	133	125	37	71	122	20	70	124	27	729
2001-02	346	419	1	174	492	1	453	898	3	2,787
2002-03	316	205	2	335	241	0	933	497	3	2,532
2003-4	146	146	4	100	167	0	214	619	1	1,397
2004-5										
Totals										

Source - *DRAFT 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT*

**Lower Columbia River Coho (*Oncorhynchus kisutch*):** In the lower Cowlitz, Mayfield Dam has blocked tributaries above river mile (RM) 52 since 1968 but natural production still occurs in several small tributaries of the lower Cowlitz including Olequa, Lacamas, Ostrander, Blue, Otter, Brights, Mill, Arkansas, Foster, and Hill creeks. Adults are also released each year to spawn in the Tilton River and upper Cowlitz system. Presently, most Cowlitz River coho are of hatchery origin although significant numbers of NOS have been identified and taken to the upper Cowlitz (**Table 10**) and the Tilton River system (**Table 7**). FCE of coho smolts in 2004 was 42% with 128,161 coho smolts collected a CFFF with a majority of them transported to the Cowlitz Salmon Hatchery Stress Relief ponds in 2004. Total smolt production was 308,079. Based on a maximum potential egg deposition of 92 million eggs, egg-to-smolt survival was 0.33%.

The Northwest Power Planning Council's model estimated smolt production capacity of 123,123 for the lower Cowlitz River, 131,318 for Tilton River and Winston Creek, and 155,018 for above Cowlitz Falls.

**Table 10.** Hatchery Coho adults transported to the Upper Cowlitz River Basin, 1996 - present.

Year	UM – Unmarked Coho			AD – Adipose Clipped Coho			Totals
	UM-Female	UM-Male	UM-Jack	AD - Female	AD - Male	AD – Jack	
1996-7	0	0	0	932	594	629	2,155
1997-8	0	0	0	2,774	1,262	464	4,500
1998-9	0	0	0	4,128	4,140	3,154	11,422
1999-2000	2,398	2,383	120	10,594	11,635	7,197	34,327
2000-01	514	778	284	14,653	16,674	9,566	42,469
2001-02	1,150	1,644	96	15,504	21,564	1,497	41,455
2002-03	3,661	4,688	416	23,698	30,490	6,300	69,253
2003-04	3,477	4,511	484	9,526	11,169	6,143	35,310
2004-05							
Totals	11,200	14,004	1,400	81,809	97,528	34,891	240,891

Source - *DRAFT 2004 ANNUAL REPORT FOR THE COWLITZ FALLS PROJECT*

**Columbia River Chum salmon (*Oncorhynchus keta*)** listed as “threatened” under the ESA on March 25, 1999. Chum were reported to historically utilize the lower Cowlitz River and tributaries downstream of the Mayfield Dam site. Typically less than 20 adults are collected annually at the Cowlitz Salmon Hatchery with adults hauled downstream to suitable spawning habitat areas. In the 1990s November commercial fisheries were curtailed and retention of chum was prohibited in Columbia River sport fisheries.

### 2.2.3 Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take.

*Describe hatchery activities:* The following hatchery activities are identified in the ESA Section 7 Consultation “Biological Opinion on Artificial Propagation in the Columbia River Basin” (March 29, 1999). In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities. Broodstock collection activities will directly handle listed fish and will have take tables associated with direct broodstock collection or with listed fish lost during handling for release. These tables will occur at the end of this HGMP.

#### **Broodstock Program:**

*Broodstock Collection:* The Cowlitz Barrier Dam adult collection facility enables the program to discriminate all returning adult fish according to hatchery and natural origin fish, since the program fish releases are 100% marked. The ability to discriminate hatchery/natural origin fish assures that the program/stock adheres to proper integrated stock criteria, particularly populations in the upper Cowlitz River and tributaries. All wild salmonids collected are transported to the upper Cowlitz basin and tributaries for natural spawning. Mortality during transport is reported at the end of this document.

*Genetic introgression:* When it began, the broodstock for this program used naturally produced coho salmon from the Cowlitz River and the management plan for the hatchery prevents any other stock of coho salmon to be used in the broodstock or released into the basin. Few transfers into the basin have occurred since the program was started. Egg takes are representative of adult

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arriving throughout the run and the current collection protocol best preserves the one “wide range timing” of the historical coho stock in the system.

### **Rearing Program:**

*Operation of Hatchery Facilities:* See HGMP section 4.2 for water withdrawal, intake screening compliance and hatchery effluent discharges.

*Disease:* Outbreaks in the hatchery may cause significant adult, egg, or juvenile mortality. Over the years, rearing densities, disease prevention and fish health monitoring have greatly improved the health of the programs at Washougal/Skamania Hatcheries. Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries (IHOT 1995) chapter 5 have been instrumental in reducing disease outbreaks. Although the hatchery has been noted as potential sources of fish pathogens including bacterial kidney disease, *Ceratomyxa shasta*, and IHNV, these diseases are also present in the natural spawning populations (Tacoma Power 2000).

### **Release:**

*Hatchery Production/Density-Dependent Effects:* To reduce interactions between coho hatchery fish and ESA-listed fish, hatchery production for all species through out the 35 year re-licensing term in the remodeled facility will be established after rebuild (>2008) and negotiations with NOAA, WDFW and Tacoma Power. Releases from 2003 will be 3.2 million, with the after remodel (>2008) level reduced further to 2.3 million pending agreement on upstream credit mechanisms (Section 3.7 FHMP), fish passage improvements and upper basin overall productivity. Any future hatchery consultation will be in the overall context or to meet the goal of reestablishing self-sustaining population levels consistent with a viable ESU scenario. When the plan is updated, NOAA Fisheries will be consulted to determine if re-initiation of the consultation is warranted. At which time, NOAA Fisheries will consider the potential for both beneficial and adverse effects to listed species.

*Competition:* Salmon and steelhead feed actively during their downstream migration (Becker 1973; Muir and Emmelt 1988; Sager and Glova 1988). If they do not migrate they could compete with wild fish. The SIWG (1984) concluded that “migrant fish will likely be present for too short a period to compete with resident salmonids. Once in the lower Columbia River mainstem of tidal influence, in a study designed to define the migrational characteristics of chinook salmon, coho salmon, and steelhead trout in the Columbia River estuary, Dawley et al (1984), found the average migration rates for subyearling chinook, yearling chinook, and coho salmon and steelhead, were 22, 18, 17, and 35 Rkm daily respectively.

*Predation:* Hawkins and Tipping (1999) reported that in 1998, yearling stock coho, steelhead and cutthroat sampled on the Lewis River, Washington contained Chinook salmon fry. For impact on listed Chinook, coho or steelhead, some overlap of predator and prey needs to occur but actual habitat preferences, spatial separation or behavioral characteristics during the potential overlap period are unknown. Several risk factors have been associated with predation:

### **Predation Risk Factors:**

Environmental Characteristics: These characteristics can influence the level of predation (see SIWG 1984 for a review) with risk greatest in small systems during periods of low flow and high clarity. The Cowlitz River is a very large river system averaging 6,664 and 7,490 cfs during April and May (Real Time average 1934- present). Below I-5, the Toutle River, a large tributary of the Cowlitz River adds another 2,000 – 2,600 cfs to the system.

Dates of Releases: Coho are released mid-April to May 1<sup>st</sup>. Listed Chinook from the Lower Columbia ESU believed to be present in many systems over a wide rearing and

migration window from March thru August. Listed winter steelhead can be emerging during a portion of the release period with 50% swim up occurring by mid-June (**Table 11**).

**Table 11.** Steelhead Spawn and Emergence Windows.

Race	Spawn Time	Peak Spawn Window	Incubation to Hatch	Swim-up Window	Swim-up @ 50% Date	Source
Winter	March – May	April 15 - 25 <sup>th</sup>	May 13 – June 15	May 27- July 7	June 17	LCSI Draft 1998
Summer	February –April	March 20-30 <sup>th</sup>	April 14 – May 18	April 28 – June 2	May 15	Kalama River Research Report 2003

Relative Body Size: Salmonid predators were thought to be able to prey on fish up to approximately 1/3 of their length (USFWS 1994), although coho salmon have been observed to consume juvenile chinook salmon of up to 46% of their total length or larger in aquarium environments (Pearsons et al. 1998). The “33% of body length” criterion for evaluating the potential risk of predation in the natural environment has been used by NOAA Fisheries and the USFWS in a number of biological assessments and opinions (c.f., USFWS 1994; NMFS 2002). Although predation on larger chinook juveniles may occur under some conditions, WDFW believes that a careful review of the Pearson and Fritts (1999) study supports the continued use of the “33% of body length criterion” until further data for individual rivers can be collected. Yearling coho releases at 15 ffp (136 mm fl) pose an unknown risk on listed fish of approximately 41 mm fl and smaller as *O. kitsuch* smolts are large enough to consume wild Chinook salmon fry (Pearsons and Fritts, 1999). Listed steelhead fry could also fall within predation length.

Release Location and Release Type: The release from the Cowlitz Salmon Hatchery is directly to the lower river at Rkm 78.8 below the upper river productivity. Although the release is not totally volitional, most fish quickly vacate the pond as soon as screens are removed. Based on past history, time and size release parameters, fish are in a smolted condition and could be migrating quickly upon release.

*Residualism:* To maximize smolting characteristics and minimize residualism, WDFW adheres to a combination of acclimation, size, and time guidelines. Limited evidence of residualism from coho programs following the following guidelines and fish culture practices has been indicated from snorkeling studies on the Elochoman River (Fuss 2000).

- Condition factors, standard deviation and co-efficient of variation (CV) are measured through out the rearing cycle and used for determining release time.
- Feeding rates and regimes through out the rearing cycle are programmed to satiation feeding to minimize out of size fish and programmed for smolt phase as release or plant times approach.
- Based on past history, fish have reached a size and condition that indicates a smolted condition at release.
- Releases occur within known time periods of species emigration from acclimated ponds.

*Migration Corridor/Ocean:* Once in the main stem, Witty et al. (1995) has concluded that predation by hatchery production on wild salmonids does not significantly impact naturally produced fish survival in the Columbia River migration corridor. Evidence in estuarine and nearshore environments indicate that diets are often dominated by invertebrates with Durkin

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(1982) reporting that diet of coho smolts (128-138 mm fl) in the Columbia River estuary was composed almost entirely of invertebrates without evidence of salmonids as prey (HSRG - Hatchery Reform 2004). Once reaching the Columbia River, fish appear to travel quickly. In a study designed to define the migrational characteristics of chinook salmon, coho salmon, and steelhead trout in the Columbia River estuary, Dawley et al (1984), found the average migration rates for subyearling chinook, yearling chinook, and coho salmon and steelhead, were 22, 18, 17, and 35 Rkm/d respectively. There appear to be no studies demonstrating that large numbers of Columbia system smolts emigrating to the ocean affect the survival rates of juveniles in the ocean in part because of the dynamics of fish rearing conditions in the ocean.

### **Monitoring:**

*Associated monitoring Activities:* Interaction between hatchery and wild adult salmonids will be managed by monitoring key tributary escapements of coho, steelhead, cutthroat and chum. Interaction between hatchery-released fish and wild fish in the lower Cowlitz will be studied and may result in review of release strategies.

The following monitoring baseline activities are conducted in the Lower Columbia Management Area (LCMA) for adult steelhead and salmon: redd surveys are conducted for winter steelhead in the SF Toutle, Coweeman, EF Lewis and Washougal rivers. Redd surveys are also conducted in the Cowlitz River for fall and spring chinook. Mark-recapture surveys provide data for summer steelhead populations in the Wind and Kalama rivers. Mark-recapture carcass surveys are conducted to estimate populations of chinook salmon in Grays, Elochoman, Coweeman, SF Toutle, Green, Kalama, NF Lewis, EF Lewis, rivers and Skamokawa, Mill, Abernathy, and Germany creeks and for all chum salmon populations. Snorkel surveys are conducted for summer steelhead in the EF Lewis, Washougal rivers. Trap Counts are conducted on the Cowlitz, NF Toutle, Kalama, and Wind rivers and on Cedar Creek a tributary of the NF Lewis River. Area-Under-the-Curve (AUC) surveys are conducted to collect population data for chum salmon in Grays River and Hardy and Hamilton Creeks. All sampling of carcasses and trapped fish include recovery of coded wide tagged (CWT) fish for hatchery or wild stock evaluation. Downstream migrant trapping occurs on the Cowlitz, Kalama, NF Lewis, and Wind rivers, Cedar Creek, and will expand to other basins as part of a salmonid life cycle monitoring program to estimate freshwater production and wild smolt to adult survival rates. Any take associated with monitoring activities is unknown but all follow scientific protocols designed to minimize impact.

**Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**

Direct takes or from loss of fish from broodstock collection and release are located in tables at the back of this document. In other HGMPs provided to NOAA (Puget Sound, Upper Columbia), indirect takes from hatchery releases such as predation and competition is highly uncertain and dependant on a multitude of factors (i.e. data for population parameters - abundance, productivity and intra species competition) and although HGMPs discuss our current understanding of these effects, it is not feasible to determine indirect take (genetic introgression, density effects, disease, competition, predation) due to these activities.

**Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.**

Any additionally mortality from this operation on a yearly basis would be communicated to Fish program staff for additional guidance. For other listed species, if significant numbers of wild salmonids are observed impacted by this operation, then staff would inform the WDFW District Biologist who along with the Complex Manager would determine an appropriate plan and consult with NOAA if needed.

## Section 3: Relationship of Program to Other Management Objectives

### **3.1 Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the *NPPC Annual Production Review Report and Recommendations* - NPPC document 99-15). Explain any proposed deviations from the plan or policies.**

The production developed for this program will be integrated with *U.S. v Oregon* and the Columbia River Fish Management Plan (CRFMP) and with hatchery plans documented in WDFW's yearly Future Brood Document (FBD), and Lower Columbia Fisheries Management and Evaluation Plan (2002 FMEP) which has been agreed to by NOAA for listed steelhead, chum, and Chinook in the ESU.

For ESU-wide hatchery plans, the spring Chinook production from Cowlitz Salmon Hatchery was described in the 1999 Biological Opinion on Artificial Propagation in the Columbia River Basin and the 1999 Review of Artificial Production of Anadromous and Resident Fish in the Columbia River Basin. Current production numbers can vary from past productivity levels and reflect reductions in programs due to ESA concerns.

Hatchery programs in the Columbia system adhere to a number of guidelines, policies and permit requirements in order to operate. These constraints are designed to limit adverse effects on cultured fish, wild fish and the environment that might result from hatchery practices. The following is a list of guidelines, policies and permit requirements that guide WDFW Columbia hatchery operations:

- *Genetic Manual and Guidelines for Pacific Salmon Hatcheries in Washington.*
- *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 5, IHOT 1995).
- *Spawning Guidelines for Washington Department of Fisheries Hatcheries.*
- *Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries* (Genetic Policy Chapter 7, IHOT 1995).
- *Stock Transfer Guidelines.*
- *Fish Health Policy in the Columbia Basin.*
- *National Pollutant Discharge Elimination System Permit Requirements*

### **3.2 List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.**

- Cowlitz Basin Fish Management Plan - The Department of Fish and Wildlife has developed a framework for a fish management plan for the Cowlitz River basin. This plan is intended to provide management direction for fish protection and restoration in a manner that is consistent with the Endangered Species Act (ESA) and the Wild Salmonid Policy (WSP). The Wild Salmonid Policy was developed by WDFW in response to a mandate from the Washington State Legislature (ESHB 1309) in 1993.
- Mitigation agreement for Cowlitz Hatchery (Agreement Number FERC PROJECT # 2016 dated Aug. 9, 1967). That license expired on December 31, 2001. The Project has operated under annual licenses until the new license was issued (effective July 18, 2003). The new thirty-five year license was issued March 13, 2003, and became effective on July 18, 2003. Tacoma Power has contracted with the Washington Department of Fish and Wildlife (WDFW) to operate their Cowlitz hatcheries through 2008.

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- Cowlitz Fisheries and Hatchery Management Plan (Final August 2004).
- Lewis County Public Utility District's (PUD) Cowlitz Falls project (FERC No. 2833).

### 3.3 Relationship to harvest objectives.

General harvest objectives are to provide fishing opportunities consistent with the mandates of WDFW, the Pacific Salmon Treaty (PST), the Pacific Fisheries Management Council, US v. Oregon, and other state, federal, and international legal obligations. Specific harvest objectives will vary depending on the phase of the reintroduction and recovery program. Fishery exploitation rates are expected to increase as the status of natural populations of coho increase in the basin. Besides ocean fisheries, specific harvest objectives will vary depending on the phase of the reintroduction and recovery program.

Fisheries directed at the harvest of Cowlitz River coho operate in the lower Columbia River and in the Cowlitz River downstream of the Barrier Dam. Sport fisheries occur in the lower Columbia and Cowlitz during August-November, with total adult equivalent exploitation rates ranging from 1.7 to 7.0 percent for the 1994 through 1998 brood. Hatchery origin coho are now mass marked with an adipose fin clip. Ocean and in-river sport fisheries are selective for hatchery fish.

Marine fisheries in British Columbia, Oregon, and Washington that harvest Cowlitz River coho are expected to operate through 2008 under the provisions of the 1999 annexes of the PST. In recent years, the ocean fisheries have been harvested at a 40 percent rate. This is expected to drop to around 15 percent in the future in order to protect wild coho. Commercial fisheries in the mainstem Columbia River may occur in August and September. Currently, this is a non-selective fishery and operates in recent years at about a 25 percent rate. The non-selective aspect of this fishery is expected to continue, at least through Phase 1 of the FHMP, however at reduced rates (~15 percent).

Sport fisheries selective for adipose fin-clipped coho are expected to occur in the mainstem Columbia River and the lower Cowlitz River from August through October. Assuming a ten percent mortality rate for the release of unclipped fish, a six percent encounter rate in the mainstem Columbia, and a 30 percent encounter rate in the lower Cowlitz, the objective for the total freshwater incidental harvest rate on wild coho in these sport fisheries is 3.6 percent (FHMP).

Currently, there are selective fisheries operating upstream of Mayfield Dam that result in less than one percent mortality on NORs. It is intended to eventually expand this to allow a directed harvest of naturally produced fish at a rate near ten percent (long-term), stock strength allowing. This also assumes that coho are not listed by NOAA-Fisheries

#### 3.3.1 Describe the fisheries benefiting from the program, and indicate harvest levels and rates for program origin fish for the last twelve years (1988-99), if available.

Fisheries benefiting from this program will include:

1. Ocean recreational and commercial fisheries from the mouth of the Columbia River north to S.E. Alaska.
2. Columbia River Zone 1-3 commercial fishery
3. Columbia River Zone 1-3 recreational fishery
4. Lower and Upper Cowlitz River recreational fisheries

Coho from the Cowlitz River are harvested in a variety of sport and commercial fisheries in British Columbia, Oregon and Washington (**Table 12**). Total adult equivalent exploitation rates in all fisheries since the 1972 brood have ranged from 29.0 (1991 brood) to 97.9 percent (1972 brood), with an average exploitation rate of 72.3 percent in all years. Based on coded wire tag analysis of HOR fish, most exploitation historically occurred in ocean fisheries, primarily in Washington and off the west coast of Vancouver Island, with an average total adult equivalent exploitation rate in all ocean fisheries

## Cowlitz River Coho

of 47.8 percent for the 1972 through 1998 broods. Reductions of exploitation rates in these fisheries in recent years, particularly in response to the poor survival of many stocks in the early 1990s, resulted in ocean exploitation rates as low as 17.5 percent (1991 brood).

**Table 12. Percent of Cowlitz Coho Contribution to Largest Fisheries.**

Brood Year	WA Marine Comm.	OR Troll	Treaty Troll	WA Ocean Sport	OR Ocean Sport	Estuarine Sport	Col. River Gillnet	Fresh Water Sport
Avg. (1997-00)	0.7	1.9	0.8	32.9	16.7	3.2	42.4	0.8

### 3.4 Relationship to habitat protection and recovery strategies.

The impact associated with Tacoma Power's and Lewis PUD's continued operation of hydroelectric facilities including the dams creating Mayfield Lake, Riffe Lake and Lake Scanewa are major factors that affected natural production of resident and anadromous fish species. Project impacts to fish include:

- (1) impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related barriers, false attraction, entrainment in intakes, and other impediments to fish migration.
- (2) impacts to resident and anadromous fishes in the reservoirs, downstream, and upstream caused by project-related mitigation hatchery fish interactions with remaining wild fish.
- (3) impacts to resident and anadromous fishes in reservoirs from fluctuations in reservoir level.
- (4) impacts to resident and anadromous fishes downstream of the dams caused by project-related flow-dependent habitat changes.
- (5) impacts to resident and anadromous fishes downstream of the dams caused by project-related flow fluctuations.
- (6) impacts to resident and anadromous fishes in the reservoir and downstream caused by project-related channel changes stemming from alteration of natural sediment transport.
- (7) changes in dynamics of fish-predator interactions resulting from change in fish escape options.
- (8) changes in water quality (e.g., temperature, dissolved gases, suspended sediment, pollutants) which can impact fish (and wildlife).
- (9) interruption of the transport of large wood and nutrients from upstream to downstream reaches and nutrient transport upstream in the form of adult anadromous fish.
- (10) inundation of anadromous fish spawning, incubation, and rearing habitat by Mayfield, Mossyrock and Cowlitz Falls dams, resulting in loss of anadromous fish production from the inundated reaches.

Several Settlement Agreement articles are addressing passage way problems in the system including: Article 1 (Downstream Fish Passage for Riffe Lake and Cowlitz Falls), Article 2 (Downstream passage for Mayfield Lake) and Article 3 (Upstream Fish Passage for the barrier Dam, Mossyrock and Mayfield) deal with future proposals and improvement needed for restoring processes upstream and down. Additionally Article 11 has created a fish habitat fund of up to 3.0 million dollars for identified projects (FERC 2016).

#### **Additional Processes:**

The following processes have included habitat identification problems, priority fixes and evolved as key components to The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004).

#### *Sub-Basin Planning*



## Cowlitz River Coho

Regional sub-basin planning processes include the Cowlitz River Sub-basin Salmon and Steelhead Production Plan, September 1, 1990 with a more recent Draft Cowlitz River Subbasin Summary (May 17, 2002) was prepared for the Northwest Power Planning Council. The Sub-basin efforts provided initial building blocks for the LCFRB regional recovery plan. *The Lower Columbia fish Recovery Board (LCFRB)* has adopted The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans (Volume 1; Clark, Cowlitz, Lewis, Skamania and Wahkiakum Counties, December 15, 2004) with the understanding that Implementation of the schedule and actions for local jurisdictions depends upon funding and other resources.

### *Habitat Treatment and Protection*

Ecosystem Diagnosis and Treatment (EDT) compares habitat today to that of the basin in a historically unmodified state. EDT has been modeled for productivity in the Cowlitz basin in The Lower Columbia Salmon Recovery and Fish and Wildlife Sub-basin Plans and has been used by Tacoma Power for the FERC re-licensing agreements for the upper basin productivity goals. WDFW is also conducting a Salmon Steelhead Habitat Inventory Assessment Program (SSHIAP), which documents barriers to fish passage. WDFW's habitat program issues hydraulic permits for construction or modifications to streams and wetlands. This provides habitat protection to riparian areas and actual watercourses within the watershed.

### *Limiting Factors Analysis (LFA)*

A WRIA 26 LFA was conducted by the Washington State Conservation Commission (May 2002). WRIA 26 was separated into seven subbasins; Coweeman, Lower Cowlitz, Toutle, Mayfield/Tilton, Riffe Lake, Cispus, and Upper Cowlitz.

## **3.5 Ecological interactions.**

(1) *Salmonid and non-salmonid fishes or species that could negatively impact the program:* There are high numbers of predators in Mayfield and Riffe Lake Reservoirs, such as northern pikeminnow and rainbow trout, as well as exotic predators, such as tiger muskies, brown trout, large and smallmouth bass, bluegill, crappie, and yellow perch introduced for angling. These predators present a risk to smolts migrating through the lakes or juveniles rearing in the lakes from reintroduction programs. Once below the reservoirs, smolts can be preyed upon through the entire migration corridor from release to the mainstem Columbia River estuary. Northern pikeminnows and introduced spiny rays along the Columbia mainstem sloughs can predate on chinook smolts as well as avian predators, including gulls, mergansers, cormorants, belted kingfishers, great blue herons and night herons. Based on PIT tags recovered at a large Caspian Tern nesting colony on Rice Island, a dredge material disposal island in the Columbia river estuary, 6-25 million of the estimated 100 million out-migrating juvenile salmonids from the Columbia reaching the estuary were consumed by the terns in 1997 (Roby, et al. 1998). River otters (*Lutra canadensis*) are present in the lower Columbia region and may represent a substantial predation source on juvenile salmonids. Harbor seals (*Phoca vitulina*), Steller sea lions (*Eumetopias jubatus*), and California sea lions (*Zalophus californianus*) are commonly observed in the Columbia River estuary. Seals and sea lions reportedly prey on adult salmonids, although diet studies indicate that other fish species generally comprise the majority of their food. These mammals are often attracted to concentrated fishing effort and can be troublesome to both sport and commercial fishers by taking hooked or net-caught fish before they can be landed. Additionally, other hatchery fish may be a source of competition for Cowlitz coho.

(2) *Salmonid and non-salmonid fishes or species that could be negatively impacted by the program:* Co-occurring natural salmon and steelhead populations in local tributary areas and the Columbia River mainstem corridor areas could be negatively impacted by program fish. Of primary concern are the ESA listed endangered and threatened salmonids: Snake River fall-run chinook salmon ESU (threatened); Snake River spring/summer-run chinook salmon ESU (threatened); Lower Columbia River chinook

salmon ESU (threatened); Upper Columbia River spring-run chinook salmon ESU (endangered); Columbia River chum salmon ESU (threatened); Snake River sockeye salmon ESU (endangered); Upper Columbia River steelhead ESU (endangered); Snake River Basin steelhead ESU (threatened); Lower Columbia River steelhead ESU (threatened); Middle Columbia River steelhead ESU (threatened); and the Columbia River distinct population segment of bull trout (threatened). The potential exists for large-scale hatchery releases of fry and fingerling ocean-type chinook salmon to overwhelm the production capacity of estuaries (Lichatowich and McIntyre 1987). Estuaries may be “overgrazed” when large numbers of ocean-type juveniles enter the estuary en masse (Reimers 1973, Healey 1991). Listed fish can be impacted through a complex web of short and long term processes and over multiple time periods which makes evaluation of this a net effect difficult. WDFW is unaware of studies directly evaluating adverse ecological effects to listed salmon. See also Section 2.2.3 Predation and Competition.

*3) Salmonid and non-salmonid fishes or other species that could positively impact the program.*

Returning chinook and other salmonid species that naturally spawn in the target stream and surrounding production areas may positively impact program fish. Decaying carcasses may contribute nutrients that increase productivity of the overall system. Multiple hatchery programs salmonids releases into the Columbia river system along with listed species (section 2), benefit the program by providing additional predation opportunity in the Columbia mainstem and estuary. Numerous non-salmonid fishes sculpins, lampreys and sucker etc. also would provide the same indirect benefits.

*4) Salmonid and non-salmonid fishes or species that could be positively impacted by the program.*

A host of freshwater and marine species that depend on salmonids as a nutrient and food base may be positively impacted by program fish. The hatchery program may be filling an ecological niche in the freshwater and marine ecosystem. A large number of species are known to utilize juvenile and adult salmon as a nutrient and food base (Groot and Margolis 1991; and McNeil and Himsworth 1980). Wild co-occurring salmonid populations might be benefited as hatchery fish migrate through an area. The migrating hatchery fish may overwhelm predator populations, providing a protective effect to the co-occurring wild populations. Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Successful or non-successfully spawner adults originating from this program may provide a source of nutrients in oligotrophic coastal river systems and stimulate stream productivity. Carcasses from returning adult salmonids have been found to elevate stream productivity through several pathways, including: 1) the releases of nutrients from decaying carcasses has been observed to stimulate primary productivity (Wipfli et al. 1998); 2) the decaying carcasses have been found to enrich the food base of aquatic invertebrates (Mathisen et al. 1988); and 3) juvenile salmonids have been observed to feed directly on the carcasses (Bilby et al. 1996). Nutrient enhancement and biomass needs for the upper Cowlitz system are discussed in section 3.6.1(FHMP).

## Section 4. Water Source

### 4.1 Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile and natural limitations to production attributable to the water source.

The Cowlitz Salmon Hatchery is supplied from three sources. The majority of water is supplied from the Cowlitz River with an average 75,000 gallons per minute (gpm) available to the rearing ponds. An additional 15,000 gpm is available for the fish separator and ladder. The other two sources are "C-wells" (1,000 gpm) and "PW-wells"(700 gpm). The wells are used between August and April, normally for egg incubation and early fry rearing. Tacoma Public Utilities has a 211 cubic feet per second (cfs) water right at the Cowlitz Salmon Hatchery. An additional water right of 8 cfs was obtained for the BPA funded Stress Relief Ponds (SRP) for utilization with the upper Cowlitz River Restoration Project. Stress relief ponds have an alarm at the head box.

Runoff is predominantly generated by rainfall, with a portion of spring flows coming from snowmelt in the upper elevations and occasional winter peaks from rain-on-snow events. Flow in the mainstem is regulated in large part by the hydropower system. Mayfield Dam (RM 52) is operated by Tacoma Power and has a relatively small (133,764 acre-foot) capacity. Behind Mayfield Dam, Mayfield Lake provides little flood storage capacity and flows from Mayfield Dam are largely in response to the regulation of flows through Mossyrock Dam upstream. Flood flows in the lower mainstem have been substantially reduced due to flow regulation at the dams. Low summer flows have increased due to flow releases designed to protect the fishery resource in the lower river. In general, average summer, fall, and winter flows have increased and average spring flows have decreased since Mayfield Dam came online in 1956. This altered streamflow regime is believed to have improved conditions for some anadromous fish that spawn in the lower river but it is also believed to improve conditions for the intermediate host of the salmonid parasite, *Ceratomyxa Shasta* (Mobrand Biometrics 1999).

Two separate well systems provide 1,000 and 700 gpm, respectively, between August and April and generally are used for egg incubation and early fry rearing. During incubation, salmon *Saprolegniasis* (fungus) is the primary concern and requires daily formalin treatments at 1:600 for 15 minutes. Excessive gas in the incubation effluent is variable and may be associated with periodic increases in yolk coagulation in eggs and fry. Supersaturated Nitrogen gas conditions during high water necessitate the use of the dinitrofication tower system. Water flow to fry is kept below 6 gpm to reduce or eliminate Bacterial Cold Water Disease (BCWD). A fish pathologist routinely checks for Infectious Hematopoietic Necrosis Virus (IHNV) and Bacterial Kidney Disease (BKD). All equipment in the rearing ponds is sanitized with an iodine solution after each use. LCFRB

The temperature of water supplied to the Cowlitz Salmon Hatchery ranged from 4° to 13°C for river water, and from about 6° to 9°C for the groundwater (Harza 1997a in FERC 2001). The water is coolest during January through March and warmest during June through October. Water temperatures of the effluent from the hatchery are about the same as in the river (Harza 2000 in FERC 2001). The river and wells supply water to the Cowlitz Salmon Hatchery incubation and rearing facilities with DO levels of between 7 and 14 mg/L (Harza 1997a in FERC 2001). DO concentrations of water discharged from the Cowlitz Salmon Hatchery closely mimic those of the river (Harza 2000 in FERC 2001). In contrast, the Cowlitz Trout Hatchery gets much of its water from wells that have low DO concentrations that are increased to between about 8.5 and 11 mg/L by aerators before being supplied to incubation and rearing vessels (Harza 1997a in FERC 2001). Water in these facilities generally remains at or above 8 mg/L.

**4.2 Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.**

Potential Hazard	Risk Aversion Measure
Hatchery water withdrawal	At Cowlitz Salmon Hatchery, fish propagation water rights total almost 250 cfs including incubation water (wells) and surface water and are formalized thru trust water right S2W19889C and others* from the Department of Ecology. Monitoring and measurement of water usage is reported in monthly NPDES reports (see below).
Intake/Screening Compliance	The Cowlitz Salmon Hatchery River intake structure is not compliant with NOAA Fisheries' <i>Anadromous Salmonid Passage Facility Guidelines and Criteria (draft, January 31, 2004)</i> or WDFW's <i>Fish Protection Screen Guidelines for Washington State (WDFW, draft, June 2001)</i> . This assessment is based on structural components and the hydraulics of the intake by WDFW(November 16, 2004 Intake Assessment, Cowlitz Salmon hatchery, Ray Berg, Lead Project Engineer). Velocity through intake screens, sweep velocity, mesh openings and juvenile bypass from screens do not meet criteria. In the current plans for hatchery rebuild though (>2008), no major modification of the intakes at Cowlitz Salmon or Cowlitz Trout Hatcheries are proposed by TPU because of the uncertainty over the potential breaching of the barrier dam. Also, TPU is awaiting NOAA's Anadromous Salmonid Passage Facility Guidelines and Criteria policy to determine if the intakes will require upgrading of the intakes. The water diversion and pump intakes at the salmon hatchery do not have adequate screens and may also pose a potential risk to naturally produced chinook. Currently, the diversion and water intake structure for the Cowlitz Salmon Hatchery is located adjacent to and immediately upstream of the barrier dam and is not completely screened. There is some potential risk that some naturally produced fall chinook juveniles could be taken should they enter this structure. TPU is investigating the intake to see if reasonable measures could result in improvements.
Hatchery effluent discharges. (Clean Water Act)	<p>This facility operates under the "Upland Fin-Fish Hatching and Rearing" National Pollution Discharge Elimination System (NPDES) general permit which conducts effluent monitoring and reporting and operates within the limitations established in its permit administered by the Washington Department of Ecology (DOE). WAG 13-1021. Monthly and annual reports on water quality sampling, use of chemicals at this facility, compliance records are available from DOE. Adherence with the NPDES permit will likely lead to no adverse effects on water quality from the program on listed fish.</p> <p>Discharges from the cleaning treatment system are monitored as follows: <i>Total Suspended Solids (TSS)</i>C1 to 2 times per month on composite effluent, maximum effluent and influent samples. <i>Settleable Solids (SS)</i>C1 to 2 times per week on effluent and influent samples. <i>In-hatchery Water Temperatures</i> are monitored daily for maximum and minimum readings.</p>

\* Several additional water rights exist for groundwater well and for additional water used by BPA for the new stress relief ponds (Harza - Preliminary Draft Environmental Assessment 2001).

## Section 5. Facilities

### 5.1 Broodstock collection facilities (or methods).

The adult collection facility at the Cowlitz Salmon Hatchery consists of a barrier dam (constructed in 1969) across the river (length of 318') and an associated fish ladder. The Barrier Dam, directs migrating adult fish to the fish ladder which leads to the salmon hatchery sorting facilities. There are right and left bank entrances to the fish ladder and an under spillway transport channel connecting the two ladder entrances. Fish move up the ladder to the sorting, transfer and holding facilities. Since construction, neither the transport channel nor the left bank entrance are in use because of design problems with the attraction flow. There is also an electrical field at Barrier Dam to aid in blocking fish. Adults can be sorted to holding ponds or also held in one of six circular tanks if they are to be transported. The adults can also be transferred to a number of other ponds including two concrete ponds 100' x 20' x 5' with 2,000 gpm per pond via transfer tube.

### 5.2 Fish transportation equipment (description of pen, tank, truck, or container used).

Adult fish and occasionally juveniles, to be transported from the Cowlitz Salmon Hatchery fish separation unit, are held in one of six 643 cubic feet circular tanks at the adult trap and separator. Tanker trucks are capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to the adult fish. The trucks are equipped with flumes for planting fish wherever there is adequate access for these trucks along the river. In addition, several smaller tankers with air stones (one 750 gallon, one 1,000 gallon, one 1500 gallon and several 250 gallon tanks) are utilized for moving fish around the facilities. Adult upriver hauls can take up to one hour

### 5.3 Broodstock holding and spawning facilities.

Adults are separated to the following ponds for holding or transfer. The circular tanks are designed to hold up to 1,250 pounds of fish.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
6	Circular Separator Tanks	643	-	-	-	-
5	Concrete Ponds	10000	100	20	5.0	2000

#### 5.4 Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Heath Techna Vertical Stack Units (16 trays/Stack Unit)	216 (3456 Trays)	3-5	-	7000	7000

There are 272 stacks of vertical incubators (Heath Techna). TPU proposal calls for replacing these with 140 stacks of new vertical stack incubators. Each stack consists of 16 trays which are divided into two 1/2 stacks of 8 trays with separate water supplies. Each half-stack has a separate water supply at 3 gpm (to hatch).. Fry are incubated at 5 gpm (to ponding) and confined in ConWed substrate to discourage excessive swimming.

#### 5.5 Rearing facilities.

The Cowlitz Salmon Hatchery has 36 modified Burrows ponds and 17 ponds (kettles). In addition, 12 BPA Stress Relief Ponds and two starter vessels were added to this facility in 1996 to assist the Upper Cowlitz River Reintroduction Program. See also below:

Ponds (No.)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Max. Flow Index	Max. Density Index
36	Modified Burrow Ponds	16000	100	20	8.0	2000	1.61	0.3
17	Concrete Kettle Ponds	4000	100	5	8.0	330	1.61	0.3
1	Concrete Raceway	2000	100	5	4	330	1.61	0.3

#### 5.6 Acclimation/release facilities.

**From CSH:** Releases are from rearing ponds (see section 5.5) discharging into the Cowlitz River upstream of the fish barrier dam.

**For upper river natural smolt releases:** The upper Cowlitz Falls Dam presents a barrier which impedes or prevents downstream migration of smolts from the Upper Cowlitz. However, the dam includes a juvenile collection system with smolts taken to the Cowlitz Salmon Hatchery Stress Relief ponds until fish have acclimated for several days and then released.

**5.7 Describe operational difficulties or disasters that led to significant fish mortality.**

Due to leaking end walls and kettle gates on the south side, a shortage of – 424,292 coho fry occurred between kettle inventories and mass marking to ponds. During the fourth quarter, 3 ponds of coho were treated for Bacterial Coldwater disease. These ponds had lower flows due to plugged 1 inch jets and hatchery staff had to clean the jets out on a regular basis to keep water flow in these ponds. The coho have gone over the contracted allowable flow indexes since the third quarter of 2003. This is due to the number of available ponds and constricted flows to the coho ponds. Sand and debris still accumulate in these small inlet jets and reduce water flow from the optimum of 2,300 gpm in the rearing ponds. This flow constraint contributes to causing the flow indexes to exceed the allowable contract value of 1.0 in the coho and fall chinook ponds. End walls on the south side of the hatchery still leak profusely, even after gaskets were replaced by T.P. employees. These leaking end walls allow juvenile salmon to escape from the ponds into the center channel and then out to the river via the waste way making inventory control impossible. These end walls also leak water from the center channel into the juvenile rearing ponds. This allows infectious organisms from the returning adults to infect the juvenile fish being reared on that side of the hatchery. Kettle gates have also allowed fry to escape during planting of our yearling smolts. This problem was addressed by T.P. employees by cementing some of the kettle gates closed.

**5.8 Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.**

During trapping season, tanker trucks are capable of hooking to the underside of the circular tanks and receiving fish through displacement of water. This process results in low stress to any listed adult fish.

The hatchery has two back-up generators located in separate sheds. One of these generators has sufficient capacity to operate the two-200 hp pumps and two of the 600 hp pumps along with the residences in the event of a power outage. A new 1.5 KBW generator with upgraded switching equipment was also installed in 1999. The new generator is capable of supplying the power previously supplied by the three previous generators combined. Tacoma Public Utilities has retained the 600 KW generator and switching equipment in case the new generator should ever fail. Tacoma Public Utilities staff maintains the facility. Tacoma Public Utility staff and Washington Department of Fish and Wildlife Staff test the emergency systems weekly. In event of system failure, there is an extensive alarm system capable of identifying problems in critical areas of the hatchery. At the stress relief ponds, water is stored in empty ponds for flushing in case fish need to be released due to lack of flow. Also, a water supply shunt valve was installed in 1999 to bypass the de-nitrification columns to provide water during the time the auxillary power is being used.

## Section 6. Broodstock Origin and Identity

### 6.1 Source.

Broodstock for the Cowlitz Coho program has been from fish returning to the system and trapped at the Cowlitz salmon Hatchery trap and separation units.

#### 6.2.1 History.

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Cowlitz River Type N Coho	H	1970	Present

Coho were historically abundant in the subbasin; the Washington Department of Fisheries (1951) estimated that coho escapement was about 32,500 fish. In the Cowlitz River, an average of 24,579 coho were counted past Mayfield Dam in 1961 through 1966 (Thompson and Rothfus 1969). were observed, Two spawning peaks fish. which were classified as early-run and late-run. Currently, the coho type is considered an N-Type stock. This is more a management designation of harvest contribution areas north of the Columbia River. Broodstock are collected from adults retuning throughout September through January.

#### 6.2.2 Annual size.

From 1967 – 1999, return levels have averaged 22,293. Recent trend from 2000- 2004 has increased to an average of 54,665 fish. Since mass marking of coho from Cowlitz Salmon (1997 brd), wild coho escapement trucked to the upper watershed since 1999 has averaged 6,350 adults.

#### 6.2.3 Past and proposed level of natural fish in the broodstock.

Past levels of natural fish in the broodstock is unknown. Hatchery coho have been planted in the Cowlitz since at least 1915, as releases from the Tilton River Hatchery which operated downstream of Morton until 1921. Stock mixing probably began in 1915 (DeVore 1987). The level of natural fish in the broodstock will not be determined until the integrated program starts depending on the level of upriver production.

#### 6.2.4 Genetic or ecological differences.

Historically, 2 separate runs of coho salmon were reported to enter the Cowlitz River. The early run (Type-S) entered the Cowlitz from late August and September, with a spawning peak in late October. The late run (Type-N) entered the Cowlitz from October through March, with a spawning peak in late November (WDF and WFC 1948 as cited in Dammers et al. 2002). Most coho in the Cowlitz River basin are of hatchery origin. DeVore (1987) examined the 1982-brood hatchery release and concluded wild/natural production was minor. Coho destined for areas above the Mayfield Dam provided the broodstock for this program. The broodstock is a combination of all populations that occurred above the dam including an early timed run and a later run timed coho. Minimal coho releases from outside the basin have occurred. The Cowlitz Hatchery coho stock is considered representative of the Upper and Lower Historical populations under NOAA's proposed listing determination (69 FR 33102; 6/14/2004).



### **6.2.5 Reasons for choosing.**

Hatchery coho salmon were derived from the local population and are representative of the natural origin population. Cowlitz River coho are managed for a large range of return timing; but the later Type-N stock returns after the fall chinook season, so their harvest in the Columbia River gill-net fishery was not affected by chinook conservation efforts. The Type-N stock has dominated Cowlitz Hatchery production because catch distribution favors the Washington ocean fishery rather than the fisheries south of the Columbia River (WDW 1990).

### **6.3 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.**

Broodstock are selected over a wide range of coho escapement back to the hatchery to best represent the historical timing of the run. Eggs are taken from three time periods with the first group made up of adults arriving during the period of September 23, 2002 through October 17, 2002 (45% of yearling released). The middle group is made up of adults arriving during the period of October 18, 2002 through November 21, 2002 (45% of yearling released). The late group returned to the hatchery from November 22, 2002 through January 25, 2003. Progeny from “late” arriving adults have historically been only 10% of the yearling release.

## Section 7. Broodstock Collection

### 7.1 Life-history stage to be collected (adults, eggs, or juveniles).

Adults returning to Cowlitz Salmon Hatchery.

### 7.2 Collection or sampling design

At the base of the barrier dam (designed to stop/reduce all adult fish migration upstream) is a fish ladder leading to a trap and a fish separator. Adults can be sorted/separated into appropriate ponds for holding until spawned.

Collection for coho broodstock is taken from three time periods. The early group was made up of adults arriving during the period of September 23, 2002 through October 17, 2002 (45% of yearling released). The middle group was made up of adults arriving during the period of October 18, 2002 through November 21, 2002 (45% of yearling released). The late group returned to the hatchery from November 22, 2002 through January 25, 2003. Progeny from “late” arriving adults have historically been only 10% of the yearling release.

### 7.3 Identity.

All fish are hand sorted at the Cowlitz Salmon Hatchery and only hatchery identified fish of the appropriate time and number are retained for spawning use. All wild coho are transported to the upper basin. Excess hatchery-origin fish are transported to the upper basin at WDFW Fish Managements direction.

#### 7.4 Proposed number to be collected:

##### 7.4.1 Program goal (assuming 1:1 sex ratio for adults):

A total of 1,549 males, 1,520 females and 81 jacks were collected for broodstock. This put collection AHN by 378 adults and 26 jacks. The average egg fecundity of coho females for the 2002 brood was 3,832-eggs/per hen.

##### 7.4.2 Broodstock collection levels for the last twelve years (e.g. 1990-2001), or for most recent years available.

Year	Adults		
	Females	Males	Jacks
Planned	2700	2700	
1990	3423	2815	154
1991	4117	2993	110
1992	3968	3118	137
1993	2619	1949	130
1994	2637	1913	65
1995	3096	2585	164
1996	4158	2849	98
1997	3259	2878	16
1998	3136	3035	65
1999	2388	2301	71
2000	2119	2002	97
2001	1940	2162	21
2002	1,360	1,313	45
2003	1,187	1,123	28
2004	NA	NA	

### **7.5 Disposition of hatchery-origin fish collected in surplus of broodstock needs.**

All adults above hatchery need were transported above Cowlitz Falls Dam to Lake Scanewa.. Adult coho return to the Cowlitz Salmon Hatchery separator are sorted and those fish designated for the upper watershed were placed in holding tanks. Fish are transported and released by Tacoma Power at the boat launch to Lake Scanewa at the LCPUD Day Use Park. Tacoma Power has also released about 250 adult coho per week into the Cowlitz River at the town of Packwood to enhance spawner distribution and recreational angling opportunity at that location. Along with fall Chinook, spring Chinook and steelhead, the trap and haul program has re-established some anadromous salmonid production in the Upper Cowlitz River Basin and has been most successful with coho salmon. Under the draft FHMP, no restrictions on placing hatchery fish upstream will occur until a trigger of 40% fish passage survival is achieved with current survival under 20%. More than 204,000 hatchery coho adults have been hauled upstream since 1996.

### **7.6 Fish transportation and holding methods.**

Fish used for broodstock are held in ponds that are 20' X 100' X 5.5' or in the circular separator tanks if needed. From here they can be transferred from the ponds to the spawning room where they can be checked for ripeness, anesthetized and spawned or returned to a holding pond via a return tube (if not ripe). For hauling adults to the upper basin, 1500, 1000 and 750 gallon tanker trucks are used. Normal transit time is 30-60 minutes.

### **7.7 Describe fish health maintenance and sanitation procedures applied.**

Broodstock can be inoculated with antibiotics for furunculosis and treated with formalin for fungus. All equipment used for broodstock collection is sanitized using an iodine solution.

### **7.8 Disposition of carcasses.**

Prior to 1999 brood year, all spawned carcasses and mortalities were buried at a Tacoma Public Utilities upland site. Beginning with 1999 brood coho, unspawned carcasses (due to high fecundity and program change) were distributed downstream of the salmon hatchery for nutrient enhancement. High quality fish, are also distributed to food banks while the Cowlitz tribe received 878 adults in 2002. There were 20 males donated to various fair displays and a total of 535 adults were nutrient enhanced. These fish were all coded wire tagged which were recovered and were beyond spawning needs.

### **7.9 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.**

The program has guidelines for acceptable contribution of hatchery fish to natural spawning.

## Section 8. Mating

### 8.1 Selection method.

Broodstock are selected over a wide range of coho escapement back to the hatchery to best represent the historical timing of the run. Eggs are taken from three time periods with the first group made up of adults arriving during the period of September 23, 2002 through October 17, 2002 (45% of yearling released). The middle group is made up of adults arriving during the period of October 18, 2002 through November 21, 2002 (45% of yearling released). The late group returned to the hatchery from November 22, 2002 through January 25, 2003. Progeny from “late” arriving adults have historically been only 10% of the yearling release.

### 8.2 Males.

Males and females available on a given day are mated randomly. Males are normally used once except when the following occurs; when too few males per ripe females exist then they are live spawned and returned to pond (occasionally occurs at the first and last spawnings).

### 8.3 Fertilization.

The coho sex ratio at spawning is 1:1, currently with pooled gametes from 4 females and 4 males.

### 8.4 Cryopreserved gametes.

Cryopreserved gametes are not used.

### 8.5 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

- Listed natural fish will not be used.
- Males and females available on a given day are mated randomly.
- After water (pathogen free) is added to enhance fertilization, the fertilized eggs from each female are disinfected and water hardened in an iodine solution for one hour.
- Every season, 60 ovarian fluid samples are taken to check for IHNV.
- Hands and spawning implements are rinsed in an iodophore solution between individual spawnings.

## Section 9. Incubation and Rearing.

### 9.1.1 Number of eggs taken and survival rates to eye-up and/or ponding.

Year	Egg Take	Green-Eyed Survival (%)	Fingerling-Smolt Survival (%)
1990	9901000	93.2	69.2
1991	9829000	87.6	85.5
1992	8623000	88.7	70.2
1993	6465000	87.0	90.0
1994	7442000	90.9	85.5
1995	8636350	88.2	91.1
1996	10189471	87.6	87.6
1997	8458800	85.0	94.5
1998	11053736	91.5	96.7
1999	8964300	82.4	95.9
2000	7273110	63.3	92.3
2001	7012805	91.1	94.0
2002	5,488,600	NA	NA
2003	4,328,600	NA	NA
2004	4,360,600	NA	NA

Egg take goal for 2005 is 4,266,000.

### 9.1.2 Cause for, and disposition of surplus egg takes.

Female fecundity can vary significantly with adult upriver estimates ranging from 2,500 – 3,400 eggs per female (Draft 2004 Annual Report for the Cowlitz Falls Project ) to CSH where egg fecundity for 2003 was 3,832 eggs per female (2003 CSH Annual Reports). Higher than expected egg fecundity in females and a slight buffer for incubation loss may be a few circumstances where extra eggs may be taken. In 2002, significant numbers of fry were lost due to leaking end walls and kettle gates on the south side, a shortage of – 424,292 coho fry occurred between kettle inventories and mass marking to ponds. In cases where egg survival exceeds criteria and/or surplus eggs are taken, fish would be outplanted as unfed fry into the Upper Cowlitz subbasin/tributaries or provided to cooperative programs.

### 9.1.3 Loading densities applied during incubation.

Heath vertical incubators are used from egg take through button - up. After eye-up, eggs are picked and loaded at 8,000 eggs per tray. Eggs are incubated with 3 gpm to conserve well water while fry are incubated at 5 gpm and confined in ConWed substrate to discourage excessive swimming. In recent years, coho eggs are typically 1800 to 2000 per pound.

### 9.1.4 Incubation conditions.

After eyeing and picking of the eggs, vexar, a plastic substrate, is placed into the tray to promote resting. This promotes healthier, larger and more uniform fry development. Typically, in an eight tray 2 stack incubation unit with eggs, influent water to top tray is 11 parts per million (ppm) and effluent water (bottom tray) is ~9 ppm at < 10 degrees C (50 degrees Fahrenheit). Influent total gas continues to be variable and sometimes unacceptably high depending upon well and other water sources. Total gas in influent water in the header trough has exceeded 113%, but influent water is typically above 100% saturation as measured by HARZA N.W. and the Cowlitz crew.

### 9.1.5 Ponding.

Fry are ponded when less than 1 millimeter (mm) of yolk is showing. They typically have accumulated ~1780 Temperature Units (TU's), are ~1500 fish per pound (fpp) and are ~36 mm long. At the Cowlitz Salmon Hatchery these fish are usually ponded during February/March. Ponding is forced, as Heath incubators do not lend themselves to volitional ponding of swim-up fry.

### 9.1.6 Fish health maintenance and monitoring.

Every season 60 ovarian fluid samples are taken to check for IHNV. Salmon fungus (*Saprolegniasis*) is the primary concern during incubation requiring daily treatments with formalin at 1:600 for 15 minutes. Water flow to fry below 6 gpm is known to reduce or eliminate Bacterial Cold Water Disease (BCWD) in the early life history of salmon in vertical incubators. While eggs are incubated at 3 gpm, fry are incubated at 5 gpm and confined in ConWed substrate to discourage excessive swimming.

Excessive gas in the incubation influent water is variable and appears to be associated with periodic increases in yolk coagulation in eggs and fry. In some years, coho are especially prone to fragmented yolk showing up with fry after hatching.

Mortality from iron bacteria in the past occurred in the water supply from PW-Well #3. The well was eliminated as a source of incubation water.

### 9.1.7 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

- From 220 – 500 temperature units, eyed eggs are resistance to shock during transportation, handling and loading of the eggs into the incubators.
- Eyed eggs can survive loss of water for extended periods of time and if due to silt or high water problems can be drained of water and kept moist until water conditions allow continued operations.
- Eggs and alevins are protected from predators until the free swimming stage.
- An additional tray can be used to minimize silt or sediment problems.
- Egg loss is monitored and dead eggs are removed to prevent fungal spread from one egg to another.

### 9.2.1 Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1990-2001), or for years dependable data are available.

See Section 9.1.1

### **9.2.2 Density and loading criteria (goals and actual levels).**

In recent years, there has been an increased emphasis on controlling numbers of fish reared to enhance quality. Fish smaller than 100 fpp are routinely kept under 3 lbs/gpm flow and under 0.5 lbs/ft;. At planting, Cowlitz coho, assuming a flow of 2,000 gpm, recently are at a flow index of ~1.54 and a density index of ~0.186.

After CSH remodel (> 2008), density and flow indices will be kept at 0.40 lbs. Fish/cu.ft./in., and 2.00 lb.fish/gpm/in. (Article 7, FERC 2016).

### **9.2.3 Fish rearing conditions.**

CO<sub>2</sub> has not been measured in recent years. Total gas and corresponding dissolved oxygen (DO's) have been extensively monitored by HARZA N.W., contractors with Tacoma Power. Due to the recirculating nature of the Cowlitz ponds, DO levels of influent and effluent water are unpredictable with some readings of DO higher at discharge than inflow. In March, 1996 with water temperature at 8 °C, a heavily loaded pond with 21,100 pounds of fish had 8.4 ppm O<sub>2</sub> influent and 9.0 ppm O<sub>2</sub> in effluent water.

In both ponds and kettles at Cowlitz Salmon Hatchery, DOs in effluent water can sometimes exceed DOs of influent water. For example, at 8 °C, a kettle with 733 pounds of fish had an influent DO of 10.2 ppm and an effluent DO of 11.4 ppm. This situation is possibly due to the relative amounts of saturated gasses in the influent water vs. that of effluent. In ponds, studies of flow patterns indicate that some influent water crosses to mix directly with effluent water. This differs from how normal raceways operate. When total gas at the influent end of a kettle is at 100% saturation and O<sub>2</sub> saturation is 100%, these ponds operate as one would normally expect.



## Cowlitz River Coho

### 9.2.4 Indicate biweekly or monthly fish growth information (average program performance), including length, weight, and condition factor data collected during rearing, if available.

Rearing Period	Length (mm)	Weight (fpp)	Condition Factor	Growth Rate
March (Fry Ponding)	39.4	1400	0.00035	-
April	45.0	850	0.00035	0.393
May	61.0	240	0.00035	0.718
June	81.5	100	0.00035	0.583
July	92.2	70	0.00035	0.300
August	97.0	60	0.00035	0.143
September	102.9	50	0.00035	0.167
October	110.5	40	0.00035	0.200
November	119.1	32	0.00035	0.200
December	127.8	26	0.00035	0.188
January	139.2	20	0.00035	0.231
February	144.3	18	0.00035	0.100
March	148.8	16.5	0.00035	0.083
April	153.4	15.0	0.00035	0.091

### 9.2.5 Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See HGMP Section 9.2.4 above.

## Cowlitz River Coho

**9.2.6** Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Rearing Period	Food Type	Application Schedule (#feedings/day)	Feeding Rate Range (%B.W./day)	Lbs. Fed Per gpm of Inflow	Food Conversion During Period
1400-302	Ewos #1 Micro	8-6	3.0-2.5	0.068	0.9
302-150	Ewos #2 Micro	4-1	2.5-1.75	0.111	0.9
150-90	Ewos 1.2mm	1	1.75	0.163	0.9
90-60	Ewos 1.5mm (Short-Cuts)	1	1.75-1.50	0.044	0.9
60-25	Ewos 1.5mm	1	1.5-1.0	0.066	1.05
25-15	Ewos 2.5mm	1	1.25-1.0	0.088	1.05

### 9.2.7 Fish health monitoring, disease treatment, and sanitation procedures.

Fish Health Monitoring	Health and disease monitoring is done by pathologists currently budgeted for the Cowlitz Complex. Policy guidance includes: <i>Fish Health Policy in the Columbia Basin and Policies and Procedures for Columbia Basin Anadromous Salmonid Hatcheries</i> (Genetic Policy Chapter 5, IHOT 1995). A fish health specialist stationed at Cowlitz Complex inspects fish programs and checks both healthy and if present symptomatic fish. External signs such as lesions, discolorations, and fungal growths will lead to internal examinations of skin, gills and organs. Blood is checked for signs of anemia or other pathogens. Additional tests for virus or parasites are done if warranted.
Disease Treatment	High mortality in the 2000 brood due to EIBS, BKD and cold-water disease led to adding an extra pond to decrease density. <i>Renibacterium salmoninarum</i> , the pathogen that causes BKD in salmonids, is passed from the adult via the egg stage to the juvenile fish. <i>R. salmoninarum</i> is also transmitted by the water borne route, among fish in the rearing ponds as well as from the hatchery water supply. Fry and fingerling undergo ELISA segregation during rearing, as well as oral prophylactic treatments with Erythromycin. In the standard ponds, fry and fingerlings have been treated with Florinicol for Bacterial Cold Water Disease (BCWD). Infectious Hematopoietic Necrosis Virus (IHNV) from adults can cause low level chronic mortalities during the rearing period. Erythrocytic inclusion body syndrome has occurred in many years and predisposes fish to other diseases, such as bacterial kidney disease (BKD), fungal infections and BCWD. Frequently it occurs concomitantly with these diseases. Formalin baths were also given after marking to prevent cold-water disease and fungus from infecting the clipped area. Fish health and or treatment reports are kept on file.
Sanitation	Mortality is collected and disposed of at a landfill. All equipment (nets, tanks, boots, etc.) is disinfected with iodophor between different fish/egg lots. Different fish/egg lots are physically isolated from each other by separate ponds or incubation units. The intent of these activities is to prevent the horizontal spread of pathogens by splashing water. Tank trucks are disinfected between the hauling of adult and juvenile fish. Foot baths containing disinfectant are strategically located on the hatchery grounds to prevent spread of pathogens.

### 9.2.8 Smolt development indices (e.g. gill ATPase activity), if applicable.

Organosomatic indexes were conducted by personnel from the WDF fish health section during late 1980s and early 1990s under BPA funding. ATPase work was conducted by Wally Zaugg, NMFS, in the early 1980s and reported in the Proceedings of the N. W. Fish Culture Conference for the fish released in the Cowlitz River.

### 9.2.9 Indicate the use of "natural" rearing methods as applied in the program.

The program attempts to better mimic the natural rearing environment by rearing under natural water temperature .

### 9.2.10 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

See HGMP sections 5.8, 6.3, 7.9 and 9.1.7 for risk aversion measures taken under this propagation program.

## Section 10. Release

### 10.1 Proposed fish release levels.

**Yearling:**

Current Lower Cowlitz River production is 3.2 million yearlings.

**Other stages:**

For 2005, 241,700 eyed eggs will be used for lower Cowlitz River tributaries by cooperative groups including Friends of The Cowlitz, Cowlitz Game and Anglers, and numerous Salmon in the Classroom (SIC )school aquarium projects (FBD 2005). Additionally, 1,000 fingerlings (adipose fin-clipped) are provided for Kraus Project for a spring release into Campbell Creek. In the past, up to 1,000,000 fry could be made available for fry plants to the upper Cowlitz basin. With significant numbers of coho adults hauled upstream in past years, the plants have been discontinued as long as sufficient adults are available. In past years, excess fry were taken to Swofford Pond.

### 10.2 Specific location(s) of proposed release(s).

Age Class	Max. No.	Size (ffp)	Release Date	Location			
				Stream	Release Point (Rkm)	Major Water-shed	Eco-province
Fingerling	1000	100	April	Campbell Creek (26.0443)	*	Cowlitz	Lower Columbia
Yearling	3200000	15	May	Cowlitz River	78.8	Cowlitz	Lower Columbia
Unfed Fry	257,000	1200-1500	April	Cowlitz River Tributaries	**	Cowlitz	Lower Columbia

\*Campbell Creek is a rightbank tributary of Stillwater Creek (Tributary of Olequa Creek) located at Rkm. 12.2.

\*\* - 1700 eggs transferred to various area school aquarium projects. 240,000 eyed eggs are incubated in Remote Site Incubators (RSIs) in various lower Cowlitz River tributaries. See Friends of the Cowlitz and Cowlitz Game and Anglers Coho Unfed Fry HGMPs.

## Cowlitz River Coho

### 10.3 Actual numbers and sizes of fish released by age class through the program.

Release Year	Eggs/Unfed Fry Release			Fingerling Release			Yearling Release		
	No.	Date	Avg Size (fpp)	No.	Date	Avg Size (fpp)	No.	Date	Avg Size (fpp)
1991				547345	September	28	4404300	May	16.8
1992				1092000	August	43.7	3893200	April	14.3
1993	295000	March	1500				4587600	May	17.0
1994							4029300	May	15.1
1995				20000	April	28.5	3642400	May	10.7
1996				540355	August	90	4468827	May	16.1
1997	2834250	May	1262	1447029	August	50	4645761	May	16.0
1998	1167000	May	1300				5227597	May	11.0
1999	4035000	April	1270	701900	July	60	5382421	May	13.0
2000	635900	April	1430	15430	October	41	4736900	May	13.5
2001	646000	March	1230	596324	May	53	4847088	April	13.5
2002	527,216	March	1240	425,655	June	100	2967584	Apr/May	13.0
2003							2,874,425	Apr/May	13.8
2004							3,138,932	May	15.0

In 1993, additionally, 525,400 fed fry at 1000 fpp were released in April.

### 10.4 Actual dates of release and description of release protocols.

Yearling program release dates: In 1997 – May 1& 2, 1998 – May 1,4,5,16,19 & 22, 1999 – May 18 & 19, 2000 – May 1, 2001 – April 30. Releases are forced from rearing ponds (see section 5.5) discharging into the Cowlitz River upstream of the fish barrier dam. Coho are released from the concrete raceways which leads to a culvert entering the Cowlitz River a short distance above the barrier dam. The Barrier Dam has a electrical field that is used to discourage adult passage over the barrier dam flume during upstream migration of adults. The electrical current is turned when juveniles releases from Cowlitz Salmon are occurring upstream of the barrier dam.

### 10.5 Fish transportation procedures, if applicable.

Several small tankers with air stones (one 750 gallon, one 1,000 gallon and several 250 gallon tanks) are utilized for moving fish around the facilities or for transporting fry and fingerlings to upper watershed.

### **10.6 Acclimation procedures (*methods applied and length of time*).**

Yearling fish are acclimated on ambient river water during their entire rearing time at the hatchery.

For fish hauled from the Cowlitz Falls facility, they are held for a couple of days in the stress relief ponds before release to the Cowlitz River .

For acclimation of fish that were previously transported to upper watersheds, river water temperatures are taken to make sure they are within 7 degrees Fahrenheit of the water they are transported in. If the temperature is greater than 7 degrees, river water is circulated through the tank by pumps. This is done by draining some of the water out of the tank and pumping river water back into the tank so the fish can become acclimated to the temperature difference. This is done for approximately 15 minutes to 1/2 hour or until the tank water is within the 7 degree temperature of the water the fish are to be planted in.

### **10.7 Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.**

A 2.8% index CWT and adipose fin clip (90,000 fish) is used for survival and contribution monitoring. All other coho released from the Cowlitz Salmon Hatchery are currently mass marked.

### **10.8 Disposition plans for fish identified at the time of release as surplus to programmed or approved levels**

Without fry needed for upriver plants, the egg take goal has been reduced to reflect only what is needed for the hatchery yearling portion and approximately 260,000 eyed eggs needed for cooperative projects in the area. Also, any overage due to un-expectedly high fecundity or survival of eggs could be planted into Swofford Pond if needed as fry, sub-yearlings or yearlings if needed.

### **10.9 Fish health certification procedures applied pre-release.**

Adult salmon are routinely sampled for IHNV and BKD. ELISA sampling is done on coho and, though their progeny were segregated during rearing by ELISA values for a couple of years, this sampling is currently conducted to monitor levels of BKD in adults returning to the hatchery. BCWD is becoming increasingly more troublesome and work is ongoing to reduce problems from this disease, both through lower rearing densities and trials using new drugs. Prior to release, population health and condition is established by the Cowlitz Complex Fish Health Specialist. This is commonly done 1-3 weeks pre-release. Prior to this examine, whenever abnormal behavior or mortality is observed, staff also conducts the Cowlitz Facility Fish Health Specialist. The fish specialist examines affected fish, and recommends the appropriate treatment. Reporting and control of selected fish pathogens are done in accordance with the Co-managers Fish Disease Control Policy and IHOT guidelines.

### **10.10 Emergency release procedures in response to flooding or water system failure.**

In event of system failure, there is an extensive alarm system capable of identifying problems in critical areas of the hatchery. At the stress relief ponds, water is stored in empty ponds for flushing in case fish need to be released due to lack of flow. Also, a diversion valve has been added to the ponds to divert water from the aeration stacks directly into the ponds.

**10.11 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.**

- Releases are consistent with past history indicating the time, size and conditional release of smolts for migration fitness and smoltification occurs within nearly the entire population, which reduces residence time in the river after release.
- Current size of release experiments in the lower river will be used to improve survival and result in additional information needed for life history traits
- Physiological measures, including allowable population fork length standard deviation (STD) and coefficient of variation (CV) maximums, will be used to monitor growth and population variations
- Fish are acclimated for several weeks at the site before release.
- Innovative rearing techniques proposed in the settlement hatchery remodel will incorporate semi natural aspects of fish culture including protective pond coloration along with overhead and in-water cover on an experimental basis.

## Section 11. Monitoring and Evaluation of Performance Indicators

### 11.1.1 Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

In addition to the regional monitoring activities associated with this program, see section 2.2.3-Monitoring, the Cowlitz Hatchery evaluation Biologist monitors and evaluates the following factors associated with this hatchery program: Condition Factor of hatchery coho smolts prior to release, Smolt-to-Adult survival rates of hatchery coho releases, Freshwater harvest levels for hatchery program releases. In association with upper Cowlitz watershed recovery efforts, the Cowlitz Hatchery evaluation Biologist also operates the smolt trap at Mayfield Dam. This trap receives emigrating juveniles generated from plants and natural production in the Tilton River watershed.

As part of Tacoma Powers mitigation for the Cowlitz River dams, WDFW is funded to conduct monitoring and evaluation of the fisheries resources in the lower Cowlitz River. These include spawning and population monitoring of wild steelhead and fall chinook, angler surveys, biological sampling of the hatchery escapement and hatchery practice studies. This work is reported in the Cowlitz Fish Biologist Annual Reports (WDFW, Olympia). Populations of wild fall chinook are monitored by aerial redd counts and biological sampling of carcasses for age, mark and other population data. The aerial surveys have been conducted annually since the 1970s. Seining and CWT tagging of fall Chinook juveniles to estimate survival has also begun on the lower river.

The completion of the Surface Collection System and Fish Facilities at the Cowlitz Falls Dam in 1996 marked the beginning of a unique opportunity to restore anadromous salmonids to an estimated 240 linear miles of historically productive habitat in the upper Cowlitz and Cispus watersheds. Since then, WDFW funded by Tacoma Power, has monitored productivity of spring Chinook, late winter steelhead, coho and cutthroat trout. Fish Collection Efficiency (FCE) is monitored by mark-recapture of steelhead, coho and age-zero spring chinook smolts that are marked with visible implant elastomer tags.

The Cowlitz River Fisheries and Hatchery Management Plan is a component of the Cowlitz Hydroelectric Project Settlement Agreement with a large component of monitoring and evaluation for the upper basin recovery. Currently monitoring is being conducted as a component of the Cowlitz Evaluation Program funded by Tacoma Power. Current funded activities include: hatchery broodstock sampling for biological and mark information; Lower Columbia River fall chinook spawning ground surveys for naturally spawning fall chinook, including aerial redd counts and biological and mark examination of carcasses; tributary steelhead spawning ground surveys for abundance; operation of Mayfield Dam juvenile collector to enumerate juvenile out-migration; creel survey of lower Cowlitz and reservoir fisheries; warm water fish population composition and abundance surveys on Mayfield Lake and Swofford Pond, reintroduction of coho, steelhead, and cutthroat into the Tilton River and hatchery production evaluations. These activities focus on the Lower River and Tilton. This plan and future decisions will be guided by a Fisheries Technical Team. Fisheries obligations will be met through a combination of effective upstream and downstream passage, habitat restoration and improvement, and an adaptive management program.



**11.1.2 Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.**

Tacoma Public Utilities funds the staffing and support logistics for the program monitoring and evaluation. Staffing is comprised of and derived from a pool of personnel used in fish cultural and pathology related tasks.

**11.2 Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.**

Monitoring activities follow scientific protocol in handling listed fish. Smolts handled for data collection such as condition factor, length and weight are anesthetized with MS – 222 and placed in recovery tanks before hauling. At the salmon hatchery separation facility, adults can be transferred via water to water in the tanker truck fish to minimize stress.

## Section 12. Research

### **12.1 Objective or purpose.**

Tipping, J.M., and C.A. Busack. 2004. The Effects of Hatchery Spawning Protocols on Coho Salmon Return Timing in the Cowlitz River, Washington. North American Journal of Aquaculture 66:293-298.

### **12.2 Cooperating and funding agencies.**

Research conducted by WDFW and Funded through Tacoma Power.

### **12.3 Principle investigator or project supervisor and staff.**

Cowlitz Hatchery Evaluation Biologist

### **12.4 Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.**

### **12.5 Techniques: include capture methods, drugs, samples collected, tags applied.**

No current research. See above studies for information.

### **12.6 Dates or time periods in which research activity occurs.**

No current research. See above studies for information.

### **12.7 Care and maintenance of live fish or eggs, holding duration, transport methods.**

No current research. See above studies for information.

### **12.8 Expected type and effects of take and potential for injury or mortality.**

No current research. See above studies for information.

## Section 13. Attachments and Citations

### 13.1 Attachments and Citations

- Becker, C.D. 1973. Food and growth parameters of juvenile Chinook salmon, *Oncorhynchus tshawytscha*, in central Columbia River. Fish. Bull. 71: 387-400.
- Bilby, R.E., B.R. Fransen, and P.A. Bisson. 1996. Incorporation of nitrogen and carbon from spawning coho salmon into the trophic system of small streams: evidence from stable isotopes. Can. J. Fish. Aquat. Scit. 53: 164-173.
- Cederholm, C.J. et al. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.
- Dammers, W., P.A. Foster, M.Kohn, C. Morrill, J. Serl, G. Wade. 2002. Draft Cowlitz River Subbasin summary, prepared for the Northwest Power Planning Council. Columbia Basin Fish and Wildlife Authority, Portland, Oregon.
- Dawley, E. M., R.D. Ledgerwood, T.H Blahm, R.A. Kirn, and A.E. Rankis. 1984. Migrational Characteristics And Survival Of Juvenile Salmonids entering the Columbia River estuary During 1983. Annual Report to the Bonneville Power Administration, Portland, OR.
- Easterbrooks, J. 1980. Salmon production potential evaluation for the Cowlitz River system upstream of the Cowlitz Falls Dam site. Washington Department of Fisheries.
- Fuss, H.J., J. Byrne, and C. Ashbrook. 2000. Migratory Behavior and Incidence of Post-Release Residualism of Hatchery Reared Coho and Chinook Salmon Released into the Elochoman River, WDFW Annual Report FPA99-08.
- Harza. The 1997 and 1998 technical study reports, Cowlitz River Hydroelectric Project. Vol. 2, 35-42.
- Harza 2000. Lower Clark Fork River Fish Transport Plan. Final Report to Avista Corp. Portland, Oregon, 32 pgs.
- Hawkins, S.W., Tipping, J. M. 1999. Predation By Juvenile Hatchery Salmonids on Wild Fall Chinook Salmon Fry in the Lewis River, Washington. California Fish and Game 85(3):124-129
- Healey, M. C. 1991. Life history of chinook salmon. Pages 311–394 in C. Groot and L. Margolis (eds.), Pacific salmon life histories. Vancouver, BC: University of British Columbia Press.
- Groot and Margolis 1991
- IHOT (Integrated Hatchery Operations Team). 1995. Operation plans for anadromous fish Production facilities in the Columbia River basin. Volume III - Washington. Annual Report 1995. Bonneville Power Administration, Portland, OR. Project Number 92-043. 536 pp.

## Cowlitz River Coho

- Lichatowich, J. A., and J. D. McIntyre. 1987. Use of hatcheries in the management of Pacific anadromous salmonids. American Fisheries Society Symposium 1: 131-136.
- Mathisen, O.A., P.L. Parker, J.J. Goering, T.C. Kline, P.H. Poe, and R.S. Scalan. 1988. Recycling of marine elements transported into freshwater systems by anadromous salmon. Verh. Int. Ver. Limnol. 23: 2249-2258.
- McElhany, P., T. Bachman, C. Busack, S. Heppell, S. Kolmes, A. Maule, J. Myers, D. Rawding, D. Shively, A. Steel, C. Steward, and T. Whitesel. 2003. Interim report on viability criteria for Willamette and Lower Columbia Basin Pacific salmonids. Unpublished report. NOAA Fisheries.
- McNeil, W.J. and D.C. Himsworth. 1980. Salmonid ecosystems of the North Pacific. Oregon State University Press and Oregon State University Sea Grant College Program, Corvallis, Oregon.
- Mobrand Biometrics, Inc. August, 1999 Draft. The EDT Method. 9920 SW Bank Rd, Vashon, WA 98070. (206) 463 5003.
- Muir, W.O. and R.L. Emmelt. 1988. Food habits of migrating salmonid smolts passing Bonneville Dam in the Columbia River, 1984. Regulated River 2: 1-10.
- Myers, J.M., C. Busack, D. Rawding, and A. Marshall. 2002. Identifying historical populations of chinook and chum salmon and steelhead within the Lower Columbia River and Upper Willamette River Evolutionarily Significant Units. May 10, 2002 Co-manager Review Draft. Willamette/Lower Columbia River Technical Recovery Team.
- Pearsons, T.N., G.A. McMichael, K.D. Ham, E.L. Bartrand, A. I. Fritts, and C. W. Hopley. 1998. Yakima River species interactions studies. Progress report 1995-1997 submitted to Bonneville Power Administration, Portland, Oregon. DOE/BP-64878-6
- Pearsons, T.N., and A.L. Fritts. 1999. Maximum size of Chinook salmon consumed by juvenile coho salmon. N. Am. J. Fish. Manage. 19: 165-170.
- Reimers, P. E. 1973. The length of residence of juvenile fall chinook salmon in the Sixes River, Oregon. Fish. Comrn. Ore. Res. Briefs. 4:1-43.
- Roby, D.D., D.P. Craig, K. Collis, and S.L. Adamany. 1998. Avian Predation on Juvenile Salmonids in the Lower Columbia River 1997 Annual Report. Bonneville Power Administration Contract 97BI33475 and U.S. Army Corps of Engineers Contract E96970049. 70 p.
- Sager, P.M., and G.J. Glova. 1988. Diet feeding periodictiy, daily ration and prey selection of a riverine population of juvenile Chinook salmon, *Oncorhynchus tshawytscha*. J. Fish Biol. 33: 643-653.
- Serl, J., and Morrill, C. 2004. Draft: 2004 Annual Report for the Cowlitz Falls Project. Washington Department of Fish and Wildlife. Olympia.

## Cowlitz River Coho

SIWG (Species Interaction Work Group). 1984. Evaluation of potential interaction effects in the planning and selection of salmonid enhancement projects. J. Rensel, chairman and K. Fresh editor. Report prepared for the Enhancement Planning Team for implementation of the Salmon and Steelhead Conservation and Enhancement Act of 1980. Washington Dept. of Fish and Wildlife. Olympia, WA. 80 pp.

USFWS (U.S. Fish and Wildlife Service). 1994. Biological assessment for operation of U.S. Fish and Wildlife Service operated or funded hatcheries in the Columbia River Basin in 1995-1998. Submitted to National Marine Fisheries Service (NMFS) under cover letter, dated August 2, 1994, from William F. Shake, Acting USFWS Regional Director, to Brian Brown, NMFS.

Washington Department of Fisheries (WDF). 1951. Planning Reports. Lower Columbia River Fisheries Development Program. Preliminary draft, August 1951. 211 p. + appendices

Washington Department of Fisheries (WDF), Washington Department of Wildlife (WDW), and Western Washington Treaty Indian Tribes (WWTIT). 1992. 1992 Washington State salmon and steelhead stock inventory (SASSI). Washington Dept. Fish and Wildlife, 600 Capitol Way N, Olympia, WA. 98501-1091. 212 pp.

Washington Department of Fisheries (WDF) and Washington Department of Wildlife (WDW). 1993. 1992 Washington State salmon and steelhead stock inventory - Appendix three Columbia River stocks. Washington Dept. Fish and Wildlife, 600 Capitol Way N, Olympia, WA. 98501-1091. 580 pp.

WDW (Washington Department of Wildlife), Confederated Tribes and Bands of the Yakima Indian Nation, Confederated Tribes of the Colville Indian Reservation, and Washington Department of Fisheries. 1990. Methow and Okanogan rivers Subbasin, salmon and steelhead production plan. Available from the Northwest Power Planning Council, Portland, OR. WDW 1990

Wipfli, M.S., J. Hudson, and J. Caouette. 1998. Influence of salmon carcasses on stream productivity: response of biofilm and benthic macroinvertebrates in southeastern Alaska, U.S.A. Can J. Fish. Aquat. Sci. 55: 1503-1511.

## **Section 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY**

### **14.1 Certification Language and Signature of Responsible Party**

“I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973.”

**Name, Title, and Signature of Applicant:**

Certified by\_\_\_\_\_ Date:\_\_\_\_\_

## Cowlitz River Coho

Take Table 1. Estimated listed salmonid take levels by hatchery activity.

### *Spring Chinook*

ESU/Population	Lower Columbia River Spring Chinook
Activity	Cowlitz Type N Coho Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (Rkm 78.8)
Dates of activity	September-March
Hatchery Program Operator	WDFW

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)				
Collect for transport (b)				
Capture, handle, and release (c)				
Capture, handle, tag/mark/tissue sample, and release (d)				
Removal (e.g., broodstock (e)				
Intentional lethal take (f)				
Unintentional lethal take (g)			0*	
Other take (specify) (h)				

\*Spring chinook are not present during program operation.

- Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
- Take associated with weir or trapping operations where listed fish are captured and transported for release.
- Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
- Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
- Listed fish removed from the wild and collected for use as broodstock.
- Intentional mortality of listed fish, usually as a result of spawning as broodstock.
- Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
- Other takes not identified above as a category.

## Cowlitz River Coho

Take Table 2. Estimated listed salmonid take levels by hatchery activity.

### Fall Chinook

ESU/Population	Lower Columbia River Fall Chinook
Activity	Cowlitz Type N Coho Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)
Dates of activity	September-March
Hatchery Program Operator	WDFW

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)				
Collect for transport (b)				
Capture, handle, and release (c)				
Capture, handle, tag/mark/tissue sample, and release (d)				
Removal (e.g., broodstock (e)				
Intentional lethal take (f)				
Unintentional lethal take (g)			0-5	
Other take (indirect, unintentional) (h)				

- Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
- Take associated with weir or trapping operations where listed fish are captured and transported for release.
- Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
- Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
- Listed fish removed from the wild and collected for use as broodstock.
- Intentional mortality of listed fish, usually as a result of spawning as broodstock.
- Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
- Other takes not identified above as a category.



## Cowlitz River Coho

Take Table 3. Estimated listed salmonid take levels by hatchery activity.

### Steelhead

ESU/Population	Lower Columbia River/Cowlitz Late Winter Steelhead
Activity	Cowlitz Type N Coho Program
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)
Dates of activity	September-March
Hatchery Program Operator	WDFW

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)				
Collect for transport (b)				
Capture, handle, and release (c)				
Capture, handle, tag/mark/tissue sample, and release (d)				
Removal (e.g., broodstock (e)				
Intentional lethal take (f)				
Unintentional lethal take (g)			0-5	
Other take (unintentional, indirect) (h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category

## Cowlitz River Coho

Take Table 4. Estimated listed salmonid take levels by hatchery activity.

### Coho

ESU/Population	Lower Columbia River Coho			
Activity	Cowlitz Type N Coho Program			
Location of hatchery activity	Cowlitz Salmon Hatchery/Cowlitz River (RKm 78.8)			
Dates of activity	September-March			
Hatchery Program Operator	WDFW			

  

Type of Take	Annual Take of Listed Fish by life Stage (number of fish)			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass (a)				
Collect for transport (b)			0-5^	
Capture, handle, and release (c)				
Capture, handle, tag/mark/tissue sample, and release (d)				
Removal (e.g., broodstock (e)	Up to 426,000**	Up to 384,000**	Up to 3000*	
Intentional lethal take (f)				
Unintentional lethal take (g)			0-5	
Other take (unintentional, indirect) (h)				

\*Hatchery coho are proposed for listing. All fish taken for broodstock are hatchery fish.

\*\*Rearing mortality calculated as a 10% loss from egg to fry, and a 10% loss from juvenile to smolt.

^ Wild and surplus hatchery fish are transported from CSH to the upper Cowlitz watershed.

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

h. Other takes not identified above as a category

## Cowlitz River Coho

**Appendix A.** Number of salmonids collected at the Cowlitz Falls Fish Facility and smolts transported to the Stress Relief Ponds in 2004 and total collection by season from 1997-2004. {*error in transport under review*}

2004 Season	fry	Spring Chinook			Steelhead						Coho		Cutthroat		Total Fish	Total Smolt
		NP <sup>1</sup>	Hatchery <sup>2</sup>	1+	parr	hum	AD	RV+ad	RV smolt	Um smolt	fry	smolts	parr	smolts		
<b>Totals:</b>																
<i>Spring-Summer season: Continious operation April 17-August 30, 2004.</i>																
Collected	409	8,383	21,198	20	936	0	2,685	16,029	5,042	11,276	11,489	128,161	110	721	206,464	193,515
Transported	399	8,188	20,500	20			2,180	16,470	4,972	11,192		127,419		720		192,060
<i>Extended Operation: Twice Weekly Operation Sept 17- October 15, 2004.</i>																
Collected	0	330	4	0	12	0	0	0	3	33	511	14	3	1	911	385
Transported		325	3						2	32		13		1		376
<b>Total season collection by year, 1997-2004</b>																
2004	409	8,383	21,198	20	936	0	2,685	16,029	5,042	11,276	11,489	128,161	110	721	206,464	193,515
2003	3,320	7,741	26,982	18	756	0	29	16,434	170	14,740	5,177	173,540	282	1,280	250,479	240,944
2002	1,615	5,595	20,733	0	428	1	590		23,162	5,247	5,423	55,029	126	990	118,939	111,343
2001	762		36,450	25	295	4,659	242		33,491	17,807	4,405	334,718	166	1,077	434,097	428,469
2000	815		32,704		55		89		16,404	17,023	3,174	106,880	140	1,343	178,627	174,409
1999	421		8,878		4,832		31		10,783	10,001	2,269	15,120	78	545	52,892	50,159
1998	31		14,917		0		22		25,921	15,691	656	109,974	42	888	168,193	167,391
1997	18		22,815		0		37		15,621	2,777	558	3,673	103	260	46,016	45,149

1] Unmarked fish in 2004 were assumed to be naturally produced. 2003 and 2002 numbers based on fry marking a portion of fry plant with VIE marks.

2] 2004 numbers based on RV clipped fish captured.